FLORA AND MAJOR PLANT COMMUNITIES OF THE RUBY-EAST HUMBOLDT MOUNTAINS with Special Emphasis on Lamoille Canyon

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I. INTRODUCTION

The Ruby-East Humboldt Range of northeast Nevada is one of the largest and most rugged ranges in Nevada. Like the other mountains of the Great Basin the Ruby-Humboldt Range is separated from other ranges by broad valleys. The two contiguous mountain ranges extend in a southwesterly direction for about 100 miles from their northern termination near Wells. Their average width is 8 to 9 miles (Sharp 1938). Their elevation extends upward from about 6000 feet in the valley to 11,387 feet at Ruby Dome.

Lamoille Canyon, one of the larger drainages on the west slope of the Ruby Mountains was used as the basis for the vegetation study. This canyon is approximately twelve miles long. Its U-shape and steep walls denote a history of strong glaciation. The canyon heads in the high rugged peaks of the Ruby Range, some of the peaks exceeding 11,300 feet in elevation.

At the canyon mouth where Lamoille Creek enters the upper edge of Lamoille Valley the elevation is 6200 feet. Most of the data and descriptive material will apply to Lamoille Canyon unless otherwise stated.

A. Geology and Glaciation

The exposures in Lamoille Canyon are of paleoxoic (Cambrian) rock consisting of quartzites, and highly altered carbonate rock. Also scattered throughout the canyon are intrusions of granitic rock much of which has been altered by metamorphic activities.

The upper portion of Lamoille Canyon and extending to the mouth of the Right Fork is of Verdi Peak formation which consists of impure calcite marble, calcic-silicate, schist and gneiss. In lower Lamoille Canyon are exposures of Lamoille Creek quartzite, and the Oglivie formation. The latter is found only in the Lamoille Canyon nappe (a mast thrust) in this area. The Ogilvie formation consists of a mixture of calcic-silicate and impure calcite marble. Some of the better soils in the canyon are found associated with the Ogilvie. The geologic descriptions are based on Howard (1966).

Glaciation was very active in Lamoille Canyon. Two glacial periods were recognized by Sharp (1938), called the Lamoille and Angel Lake Substages. The older or Lamoille Substage was 12 miles long and extends onto the Piedmont below the mouth of the canyon. The Angel Lake Substage Glacier extends to the mouth of Right Fork, but the Right Fork Glacier extends down Lamoille Canyon for another quarter mile.

The Angel Lake Glacier was 900 feet thick at maximum. The Lamoille Glacier was obviously thicker. Thirty-four percent of the central Ruby Mountains were covered with ice during the Lamoille Substage and 27 percent during the Angel Lake Substage. A considerable time period between the substages is indicated. The canyon above Right Fork where the Angel Lake Substage was active is strongly U-shaped with very little detrital filling and erosion, while the lower canyon where only the Lamoille Glacier was active is filled with large alluvial cones. Sharp said that indications are that the time lapse between the two glacial periods was greater than between the Angel Lake Substage and the present.

B. Climate

The Ruby Mountain complex is one of the highest water producing areas in the Great Basin. Its high elevation contributes to a heavy snowpack and general precipitation. The average precipitation is over 45 inches at the higher elevations of the northern Ruby and East Humboldt Mountains, while on the south Ruby Mountains the highest average precipitation is near 25 inches.

Lamoille Canyon heads in the higher elevation of the Ruby Mountains so it would be representative of highest water yielding areas. The Humboldt River Basin Report ranks precipitation in Lamoille Canyon by elevation as follows:

6000-7000 feet	17.0 inches
7000-8000 feet	24.5 inches
8000-9000 feet	32.0 inches
9000-10,000 feet	39.5 inches
10,000 feet	47.0 inches

The precipitation information was based on records from weather station and snow courses in the canyon. A 22-year record of precipitation for the Lamoille Power House (Elev. 6290 feet) near the mouth of Lamoille Canyon furnishes some key information on the amount and distribution of precipitation. The average precipitation was 18.59 inches of which only 18.8 percent came during the four warmest months. The heaviest precipitation was in March, April, and May. Snow course records from the head of Lamoille Canyon indicate that about 80 percent of the precipitation comes in the form of snow at upper elevations.

Temperature records are scarce for the higher elevations. Records from Lamoille Power House are the only continuous temperature information for Lamoille Canyon where 28 years are available. The records follow:

Mean January maximum - 38.8° C.
Mean January minimum - 15.4° C.
Mean July maximum - 85.8° C.
Mean July minimum - 52.0° C.
Mean temperature - 45.9° C.

Comparison of temperature records with valley weather stations shows more moderate winter temperatures in lower Lamoille Canyon. The mean January minimum was from 5.5° C. to 8.5° C. lower at the Deeth, Wells, and Elko stations than at the Lamoille Power House. This temperature difference could have important ecological implications (data from U. S. Weather Bureau Records).

Maximum and minimum temperatures in Right Fork of Lamoille Canyon, June 20 to August 26, 1967, Loope (1969). See Alpine Bibliography.

	Mean Maximum	Mean Minimum
Whitebark pine stand - 8500' elevation	77°	43°
Whitebark pine stand - 9600' elevation	72°	49°
Alpine meadow - 10,000' elevation	75°	50°
Lamoille Power House - 6290' elevation	89°	49°

C. Method of Study

The objective of the study was twofold. First, to collect and identify the species, and second, to make at least a tentative classification of the major plant communities. Study sites were selected progressively up the canyon. Ocular estimates were made in each important type and all plants in identifiable growth stages were collected. Species on each study area were listed and given an abundance rating as follows:

Rating Number	Percent Composition
1	51-100
2	26-50
3	13-25
4	6-12
5	1-5
6	Less than 1

This classification scale follows that used by Ellison (1954).

Soil classifications were made in the major plant communities by William Wertz and DeVon Nelson.

Valuable collection data was found in a publication by A. A. Heller on the "Flora of the Ruby Mountains " (Heller 1911). The species list, as a part of the report, was based on personal collections and those of Utah State University. Holmgren's (1942) "Handbook of the Vascular Plants of Northeastern Nevada," was an important source of information. Plant nomenclature followed Holmgren and Reveal (1966), while nomenclature for Carex species followed Hermann (1970).

II. PLANT COMMUNITIES

The plant communities of Lamoille Canyon were grouped into three major zones, namely, the Pinyon-Juniper, Mountain Brush, and Alpine-Subalpine.

The Pinyon-Juniper was not represented in sufficient amount in Lamoille Canyon to be studied, so data was collected from near Overland Pass and along the southeast edge of the Ruby Mountains.

A large percent of Lamoille Canyon was classed in the mountain brush zone. Four major vegetation types plus additional plant communities were described for this zone. All of the types were intermixed forming a mosaic of vegetation. No one type formed a continuous unit, but each did have a relationship to elevation and site. The sagebrush type starts at the mouth of the canyon and extends to an elevation of over 9000 feet. The curlleaf mahogany community is most conspicuous on the rocky south-facing canyon wall through middle reaches of the canyon, but also alternates with aspen on the north face below the Right Fork. The snowbush community has very limited distribution in Lamoille Canyon but is a major type on the midslopes of both the northern Ruby and East Humboldt Mountains. Additional data for this community was gathered outside of Lamoille Canyon. Aspen was included in the mountain brush zone because of its intermixing with the brush types and because of its low growth form when found growing on the slopes.

Much of the high elevations are solid rock so that the alpine and subalpine communities merge into one zone. This upper zone enclosed a number of communities including conifer, alpine turf, meadows, and shrub patches.

A. Pinyon-Juniper Woodland

Pinyon-juniper woodland is one of the major vegetation types in the Great Basin. It ranks next to the sagebrush type in the area it occupies and is estimated to cover 60,000,000 acres in western United States.

Pinyon and juniper are associated through much of the pinyon-juniper ecosystem. However, they are found singly in many areas. A half-dozen species of *Pinus* and *Juniperus* are associated with the ecosystem. Only two species, single-leaf pinyon (*Pinus monophylla*) and Utah Juniper (*Juniperus osteosperma*) make up the woodland type on the Ruby Mountains. Rocky Mountain Juniper (*Juniperus scopulorum*) is present in sparse stands but in more mesic sites than those occupied by the pinyon-juniper woodland. The pinyon-juniper type is not common in Lamoille Canyon. Here it is represented by a few clumps of trees near the mouth of the canyon but is quite extensive on the south end of the Rubies.

In the southern Rubies the pinyon-juniper woodlands are found mostly between 6000 and 8000 feet elevation. The topography varies from a gently sloping pediment on the southwest portion to steep rugged slopes on the east slope of the mountain.

Most of the pinyon-juniper woodland lies within the 10- to 15-inch rainfall belt. The average mean temperature is about 45° F., and the frost-free season about 120 days. About a third of the precipitation falls during the warm season. Even so, the sites are dry and warm during most of the warm season with a precipitation of only 20 percent of the evaporation potential.

1. Vegetation Characteristics of the Pinyon-Juniper Woodland

In the pinyon-juniper community the juniper generally occupies the lower elevation and the dryer south slopes, while the pinyon extends to the higher elevation occupied by the community. Both the moisture and temperature gradients are factors contributing to the distribution of the two species. Competition is probably also a factor in that the pinyon would make more rapid growth and could dominate the sites at the upper elevation of the P-J zone. There is also a tendency for pinyon to follow juniper in the invasion of new areas. In other words, the juniper is the pioneer member of the community (Emerson 1932, Woodbury 1947, Plummer 1958, and Rasmussen 1941).

The method of seed dispersal may control the invasion pattern of the two species. Both have heavy wingless seeds which require outside agents for their dispersal. Both birds and mammals are important contributors as is gravity and overland waterflow. Juniper seeds may pass through the digestive system of birds and such animals as jackrabbits and sheep, and thus be scattered over broad areas. Also, juniper seeds may remain viable for years. Seeds of pinyon are soft and fragile and could not survive with ingestion. They are also highly palatable to small mammals. Therefore, only a chance oversight of the animals transporting and perhaps storing of the pinyon nuts would allow for an occasional seed to germinate. Most of the rodent activity would be in close proximity to the seed source (Emerson 1932, Meagher 1943). As a result of this dispersal pattern the juniper would be rather widely dispersed while the pinyon would gradually extend out from the established trees.

Another point to consider is the establishment of seedling trees. Emerson (1932) observed that young tree seedlings were found mostly in areas protected by other woody plants either of the same or a different species. Seldom were they found growing in the openings.

In his study of pinyon-juniper establishment, Meagher (1943) found that no seedlings survived except under shade (or when watered). Pinyon was particularly responsive to shade. The reasons for the high mortality was frost heaving and drought. The major cause of pinyon losses in unshaded sites was frost heaving.

Johnson (1962) in his study of one-seeded juniper found that seedling juniper had their roots in the blue grama root concentration zone the first season where it would be in direct competition with the grass for moisture. Therefore, only if the seedling could survive the first year's competition with the grass could the young tree become established.

The pinyon-juniper ecosystem can be broken down into a number of closely related communities. In their studies in west central Nevada, Blackburn, Tueller, and Eckert (1969) identified seven communities in a predominantly pinyon type. The listing of the communities from the driest to the highest moisture sites was as follows: (Symbols and common names are used.)

1. PIMO/JUOS/ARARN/CHNA (Pinyon-Juniper-Black sagebrush-rabbitbrush)
2. PIMO/JUOS/ARARN (Pinyon-Juniper-Black sagebrush)
3. PIMO-JUOS/ARTR (Pinyon-Juniper-Big sagebrush)
4. PIMO/ARTR (Pinyon-Big sagebrush)
5. PIMO/JUOS/ARARA (Pinyon-Juniper-Low sagebrush)
6. PIMO (Pinyon)
7. PIMO/SYVA/ARTR (Pinyon-Snowberry-Big sagebrush)

PIMO - Pinus monophylla, JUOS - Juniperus osteosperma, ARARN - Artemisia arbuscula nova, ARTR - Artemisia tridentata, ARARA - Artemisia arbuscula arbuscula, CHNA - Chrysothamnus nauseosus, SYVA - Symphoricarpos vaccinoides).

The pinyon, pinyon-snowberry-big sagebrush and pinyon/big sagebrush communities were found on the north and east aspects while the rest were sloping towards the south. The north oriented communities not only had generally more precipitation but obviously less evaporation.

Of the four study sites on the south Ruby Mountains, pinyon dominant communities were on east-facing slopes while the juniper dominant communities were on south and west slopes.

These studies, plus other records, indicate that the pinyon-juniper ecosystem can be divided into definite habitat types. However, the productivity classes (based on understory herbaceous plants) are dependent to a large degree on the amount of tree crown cover. The percent of crown cover may also alter the understory vegetation to change the designated habitat type.

Possibly four habitat types can be recognized on the Ruby Mountains. However, further study would be needed to confirm their identity. They are the pinyon/juniper/big sagebrush, juniper/big sagebrush, pinyon/low sagebrush, juniper/black sagebrush.

Some form of sagebrush is often associated with the pinyon-juniper, particularly where the tree cover is open enough to allow their growth. Big sagebrush, low sagebrush, or black sagebrush may be an important associate of the pinyon-juniper communities. Also, many of the grass and forb species common to the sagebrush communities are also found in the pinyon-juniper communities. Common grasses are bluebunch wheatgrass (Agropyron spicatum), cheatgrass (Bromus

tectorum), squirreltail (Sitanion hystrix), Indian ricegrass (Oryzopsis hymenoides), Great Basin wildrye (Elymus cinereus), Sandbergi bluegrass (Poa sandbergii), big bluegrass (Poa ampla), and bluestem wheatgrass (Agropyron smithii).

A large number of forb species are found in the pinyon-juniper but most of them have only occasional occurrence. Some of the more common species are phlox (Phlox longifolia and P. hoodii), milkvetch (Astragalus beckwithii, A. calycosus), wild buckwheat (Eriogonum umbellatum, E. ovalifolium), paintbrush (Castilleja chromosa), pussytoes (Antennaria dimorpha), comandra (Comandra pallida), rockcress (Arabis holboelii), wild cabbage (Caulanthus crassicaulis), daisies (Erigeron argenteus, E. bloomeri, E. aphanactis), prickly pear (Opuntia polycantha), and onion (Allium acuminatum). Numerous small annuals are common in the pinyon-juniper types. Some more common species are collinsia (Collinsia parviflora), collomia (Collomia linearis), and microsteris (Microsteris gracilis), plus several species of Cryptantha and Lappula.

Common shrubs, besides the different sagebrush, are yellowbrush (Chrysothamnus viscidiflorus), snowberry (Symphoricarpos sp.) serviceberry (Amelanchier utahensis), and bitterbrush (Purshia tridentata).

2. Production and Potential

A number of habitat factors have an influence on production output of pinyon-juniper woodlands. Because of lack of information, only such factors as soils and effect of tree overstory and understory vegetation are discussed.

Pinyon-juniper communities are found on a variety of soils from those of shallow rocky ridgetops to moderately deep soils of basins and lower slopes. The trees of the woodland appear to be at home on gravelly well drained soils, as well as on relatively shallow caliches. In studies of soil-vegetation relations Lewis et al. (1965-67) found the juniper growing mostly on gravelly loams of shallow to moderate depths (9" to 48"). Most of the soils were strongly calcic. Plummer (1958) said that soils of the pinyon-juniper woodland are characterized by rapid drainage. They are also characteristically dry most of the warm season due to the low quantity of moisture they receive and the rapid use by the plants of the limited amount that does become available.

Soil profile descriptions in the pinyon-juniper types of the southern Rubies show the soils to be loams and sandy loams and generally with a high percentage of gravel. Soil depths were from 14" to 40" (Crocket 1967).

The root systems of pinyon and juniper are well adapted to the dry habitat in which they grow. Both have strong lateral root systems as well as tap roots. The lateral roots extend out from the tree

in all directions and are largely confined to the upper 16 inches of soil. The tap roots extend well below the grass root competition zone (Emerson 1932). Johnson (1962) said that root systems of one-seeded juniper are more extensive in coarse textured soil where moisture penetration is greater. This appears to be the general case for the other woodland species. In soils with restrictive layers within a foot of the surface, the tree roots may completely occupy the soil.

The root systems of the woodland trees are not only widespread, but the cell sap osmotic pressure gives them maximum moisture gathering capacity.

Both forest products and forage should be considered in assessing production of the pinyon-juniper woodlands; however, because of the relatively low values little consideration has been given to anything but the forage. Juniper fenceposts have been important in past years, but because of harvesting costs they have lost much of their former market position. Also, the slow growth rate of Utah juniper (yearly production of one fencepost per acre per year) Herman (1953) doesn't help the marketing problem. Pinyon holds a relatively high position as a products producer for Christmas trees and for pinyon nuts; however, the nut crop is so erratic from year to year that it is not entirely dependable. Christmas trees have become a profitable forest product.

Forage production in the pinyon-juniper community has been given considerable attention by both land managers and Research. One of the major reasons for this special attention has been the adverse effects of pinyon-juniper increase on rangelands.

Students of the pinyon-juniper woodland have found an inverse relation between the percentage of tree canopy and forage (and other understory herbage) production. No data based on direct evaluation of changes is available (Jameson 1971). We do, however, have considerable data on tree canopy-forage relationships in many study areas within the woodland type. Arnold et al. (1964), Jameson and Dodd (1964), and Jameson (1971) in their work in the southwest came to the following conclusions: (1) as tree canopy increased, the understory vegetation decreased, (2) midgrasses were first replaced by blue grama as the tree overstory increased, which in turn was reduced as the tree canopy continued to increase, (3) loss of production was greater on some soils than on others (Jameson and Dodd 1964).

Blackburn et al. (1970) working in Nevada, found that pinyon and juniper invaded and increased in black sagebrush communities. As the tree overstory increased the understory plants were mostly eliminated.

Arnold et al. (1969) also observed that after tree removal a successional recovery in understory vegetation was made. After a period of ten years, the forage production leveled off at the considered potential for the site.

Another factor that may have an effect on the understory production in addition to overstory competition is the phytotoxic qualities of the juniper needles. Juniper needles have considerable growth inhibiting effect on blue grama, and particularly in heavier soils where drainage and aeration is poor (Jameson 1970).

Results of site studies carried on by the Range Management Division in five different locations in Utah and Idaho agree with the southwest studies (Lewis et al. 1965-1967), Phillips 1965). The percent canopy cover was considered to have had a definite effect on the understory herbage production; however, it was also felt that soil and other site factors were important. Phillips (1965) ran a transect from a mature stand to an open sagebrush-grass community. The mature stand had a 74-percent crown canopy and produced 96 pounds of forage per acre. The plots in the invading stand with a 1- to 2-percent cover produced from 418 to 577 pounds per acre.

Following are some interesting observations from range site studies data (Lewis et al. 1965-1967).

a. Study sites on the deep loamy soils not only produced vigorous tree growth but the understory vegetation maintained a vigorous condition.

b. The effect of tree competition was most severe on the shallower soils. Such sites were generally characterized by dead sagebrush and sparse grass (often Indian ricegrass, Oryzopsis hymenoides).

c. Production ranged from 40 to 460 pounds per acre. Areas where the trees had been removed produced as much as 900 pounds per acre. Estimated potential production based on soil depth and other soil characteristics was from 300 to 1000 pounds per acre.

B. Mountain Brush Zone

1. Sagebrush Type

Sagebrush is the most extensive vegetation type in the interior basins of western United States. The original extent of the sagebrush communities has been open to some controversy. Authors such as Weaver and Clements (1938), believed that sagebrush (Artemisia) was climax only in the central portion of the Great Basin. Much of the area of southern Idaho and northern Utah was considered to be a disclimax of Palouse Prairie resulting from overgrazing. Historical records and more recent studies lead other authors to think that the extent of the sagebrush type has not changed much since pre white man times except for the reduction in area through cultivation (Eggler 1941, Tisdale et al. 1965, Blaisdell 1958). For example, Bailey (1896)

observed that a greater part of the area between the Rocky and Sierra Mountains had sagebrush cover, and that the type extended from the valleys into the mountains to elevations of 7000 to 8000 feet. Most of the area now covered with the sagebrush type is now considered to have been a mixture of shrubs, grass, and forbs where grazing, fire, and other external influences had been at a minimum over an extended period of time. The proportion of each would depend on the site, character, and past history.

Blaisdell (1958) made the following conjecture: "Although there may have been considerable local variation from heavy stands of Artemisia to almost pure grassland, the major part of the present Artemisia-grass-forb community was probably an open stand of Artemisia intermixed with a vigorous stand of perennial grasses and forbs."

As a result of forage production studies in Region Four, a 15 to 25 percent cover of shrubs making up 20 to 30 percent of the herbage production is quite typical of sagebrush range in good or excellent condition.

The composition has been modified by grazing, fire, insect buildup, disease and various other influences. These influences were active before the advent of white men as well as since. Fires can practically eliminate sagebrush for a period of time, as can insect attacks and even excessive grazing. Laycock (1967) found that heavy fall grazing resulted in an increase in grass and forbs and a decrease in sagebrush cover. A grasshopper plague was found by Allred (1941) to cause a 50 percent death loss to sagebrush in Montana and Wyoming. Voles have also been responsible for killing sagebrush. Mueggler (1967) observed kills of 10 to 84 percent from voles. Weevil outbreaks also cause heavy sagebrush losses.

Ordinarily, sagebrush will not remain for long out of the composition on sites that were originally sage-grass communities. Pechanec et al. (1954) and Blaisdell (1953) found that sagebrush begins to reestablish soon after areas have been burned. Johnson (1969) in Wyoming found that restoration of the full complement of sagebrush requires as little as 15 to 17 years under moderate grazing use. However, where the sage-grass type has undergone excessive depletion, aggressive exotics like cheatgrass can almost completely maintain its dominance of the site (Schlatterer and Tisdale 1969).

Another point to consider is that "as a result of disturbance, mostly overgrazing, it appears that sagebrush has extended into other types where its existence is marginal " (Ellison 1960). In these marginal areas the reestablishment of a more mesic plant community could certainly hold their position against reinvasion of sagebrush.

Sagebrush is also very tenacious once it completely occupies a site. Once the associated species are reduced or eliminated from the sage-grass community the sagebrush completely occupies the site.

Blaisdell (1953) says that where sagebrush has gained control of an area, it would form a definite obstacle to establishment of other species, mainly because of its long life and ability to compete with perennial grasses and forbs for soil moisture. Schaltterer and Tisdale (1969), have also found that sagebrush produces some toxic effects on grass seedlings, and inhibits their growth at least in the early stages of their development.

The sagebrush type is very extensive in the Ruby Mountains where it extends from valleys to elevations of over 9000 feet. The type itself is not represented by a uniform community but is characterized by considerable variation depending on elevation and site characteristics. Two major divisions of the type include the big sagebrush (Artemisia tridentata) complex and low sagebrush (A. arbuscula arbuscula) and black sagebrush (A. arbuscula nova). The black sagebrush is a plant of desert valleys and low foothills and may be found associated with pinyon-juniper in our area. Low sagebrush is common to shallow soils of mid to high elevations and may extend to over 9000 feet on dry south slopes.

Big sagebrush has also been broken into a number of subspecies and forms based on morphological and ecological differences (Beetle 1960, Beetle and Young 1965, Daubenmire 1970, and Winward 1970). Both Daubenmire and Winward have defined numerous "habitat types" within the big sagebrush complex. To improve identification, chromatographic techniques are used (Winward and Tisdale 1969).

a. Big sagebrush complex

Winward broke Artemisia tridentata complex into five different taxa based on morphological characteristics, ecological requirements, phenology, and cytological studies combined with thin layer chromatography (Beetle 1960). The five taxa were:

(1) Artemisia tridentata subspecies tridentata Nutt., or basin big sagebrush. The tall form growing in deep well drained soils of the valley bottoms.

(2) A. tridentata subspecies wyomingensis Beetle, Wyoming big sagebrush. A form of the dryer slopes and shallower soils ranging up to 2½ feet in height.

(3) A. tridentata subspecies vaseyana (Rydb.) Beetle, mountain big sagebrush - found on relatively deep soils of upper foothills and mountain slopes.

(4) A. tridentata subspecies vaseyana form spiciformis (Osterhout) Beetle, subalpine big sagebrush - generally found above 7000 feet elevation.

(5) A. tridentata subspecies vaseyana form xericensis was suggested as a new form by Winward.

Each of the subspecies and forms were used as the basis for habitat types. The big sagebrush type in Lamoille Canyon fits quite well into two habitat types as described by Winward. The big sagebrush through most of Lamoille Canyon is considered to be Artemisia tridentata subspecies vaseyana. Thus, the plant community fits Winward's Artemisia tridentata vaseyana habitat types. Idaho fescue is common throughout the type. Bluebunch wheatgrass (Agropyron spicatum), Great Basin wildrye (Elymus cinereus), various species of Poa and Stipa were also important on some of the study sites (see Tables 1 and 2). Valley sedge Carex vallicola), Liddon sedge (C. petasata), and hood sedge (C. hoodii), were also quite frequent in some of the study sites. Forbs were also an important constituent of the type and consisted of such species as balsamroot (Balsamorhiza sagittata), penstemon (Penstemon watsoni and P. speciosa), stickseed (Hackelia patens), wild buckwheat (Eriogonum heracleoides, and E. umbellatum), stoneseed (Lithospermum ruderale), phacelia (Phacelia hastata), lupine (Lupinus argenteus), comandra (Comandra pallida), linanthastrum (Linanthastrum nuttallii), bluebell (Mertensia oblongifolia), and many other forbs common to the mountain sagebrush types.

Common shrubs other than the sagebrush were snowberry (Symphoricarpos oreophilus), Oregon grape (Berberis repens), yellowbrush (Chrysothamnus viscidiflorus lanceolatus), and bitterbrush (Purshia tridentata).

From the Terrace Guard Station and on to the head of Lamoille Canyon the sagebrush type changes considerably. The species associated with the sagebrush are indicators of a mesic habitat. The grasses consisted of such species as slender wheatgrass (Agropyron trachycaulum), Idaho fescue (Festuca idahoensis), mountain brome (Bromus marginatus), oniongrass (Melica bulbosa), trisetum (Trisetum spicatum), and sedge (Carex multicostata). Inclusions within the sagebrush type in the damper swales where grasses, grasslike, and forbs made up the plant cover - mountain brome (Bromus marginatus), needlegrass (Stipa columbiana), slender wheatgrass (Agropyron trachycaulum), sedge (Carex multicostata), rush (Juncus confusus). Important forbs in the sagebrush include many of the mountain forbs common to the tall forb community. Geranium (Geranium viscosissimum), tall larkspur (Delphinium stachydeum), potentilla (Potentilla glandulosa), and pokeweed fleeceflower (Polygonum phytolaccaefolium), are samples of the mesic tall forb community.

This latter community appears to be comparable with Winward's "AR-SP/BRMA/FEID" habitat type (Artemisia tridentata vaseyana form spiciformis/Bromus marginatus/Festuca idahoensis).

The soils of the big sagebrush type in Lamoille Canyon and throughout the Ruby Mountains are moderately deep of medium structure and generally of a loam texture. There is a considerable gravel content

in most of the sagebrush soils with 10 to 20 percent or more of gravel and stones in the upper horizons. This increases up to 60 percent at greater depths. Such soils have a rather high stability. However, as slopes of 60 percent and over are approached, concentrated trampling by grazing animals will cause considerable downslope movement of the surface soil. On slopes of 30 percent or less, trampling damage by grazing animals is nil.

Potential for herbage production of the big sagebrush type is basic for planning as well as judging present condition. Based on effective rooting depth of the soils, the potential production would vary from 1000 to 1400 pounds of herbage per acre. A balanced composition of shrubs, grass, and forbs will produce the maximum of the potential.

b. Low sagebrush complex

Low sagebrush (Artemisia arbuscula arbuscula) is common to the dryer slopes and ridges of the Ruby Mountains. The community is particularly common in the South Ruby Mountains. Low sagebrush may extend up warm south slopes to elevations of 9500 feet or more. Black sagebrush is a plant of low elevations and has only been observed in open pinyon-juniper.

Low sagebrush is generally found growing on shallow soils. Fosberg and Hironaka (1964) found the soils under low sagebrush to be 14 inches or less in depth. Data from Crockett (1967) show that soils of the low sagebrush community had an effective rooting depth of from 5 to 14 inches. The restricting layer was often a strongly developed B horizon. The A horizons were from 2 to 6 inches.

Species associated with the low sagebrush were similar to those found associated with big sagebrush. The following species are rated by commonness in the community: Idaho fescue (Festuca idahoensis), bottlebrush squirreltail (Sitanion hystrix), yellowbrush (Chrysothamnus viscidiflorus), Sandberg bluegrass (Poa sandbergii), shrubby buckwheat (Eriogonum microthecum), prickly phlox (Leptodactylon pungens), spike fescue (Leucopoa kingii), lupine (Lupinus spp.), paintbrush (Castilleja linariaefolia), phlox (Phlox stansburyii), and pussytoes (Antennaria spp).

Productive capacity of low sagebrush is generally considerably less than for big sagebrush. A dry weight production of 400 to 600 pounds per acre is common and much of this weight is in sagebrush herbage.

TABLE I

Sagebrush Study Sites

Site 1	Just above N.F. boundary in Lamoille Canyon 6500' elevation, SW aspect, 10 to 20 percent slope.
Site 2	Across creek from Site 1 6500-6700' elevation, NE aspect, 50 percent slope.
Site 3(a)	Bottom lands across creek from Right Fork, Lamoille Canyon 7100' elevation, SSW aspect, 5 percent slope.
Site 3(b)	Slope above the road and across from Right Fork 7400' elevation, SSW aspect, 15 percent slope.
Site 3(c)	Just under Lamoille Canyon road and across from Right Fork 7200' elevation, SSW aspect, 5 to 15 percent slope.
Site 8	Alluvial fan 1 mile below Terrace Guard Station 8000' elevation, SSW aspect, 15 percent slope.
Site 10	Toe slope above Terrace Guard Station 8500' elevation, W aspect, 25 to 35 percent slope.
Site 11	Short ridge above Site 10 8700' elevation, W aspect, 20 percent slope.
Site 12	Terrace above and east of Site 11 8800' elevation, W aspect, 20 percent slope.
Site 13(d)	Slope west of loop, head of Lamoille Canyon 9000' elevation, E aspect, 30 percent slope.
Site 13(a)	Inclusion within the sagebrush slope on Site 13(d).
Site 13(b)	Inclusion within the sagebrush slope on Site 13(d).

TABLE 2

Important Species in Big Sagebrush Community
From Lower to Higher Elevation

											Sagbr. Inclusions	
	1	2	3 (a)	3 (c)	3 (d)	8	10 (d)	11	12	13 (d)	13 (a)	13 (b)
Artemisia tridentata	2	2	2	2	2	3	2	2	4	3	0	0
Amelanchier alnifolia	4											
Symphoricarpos oreophilus	3					4		4				
Chrysothamnus sp.	5		5									
Bromus tectorum	3			3								
Agropyron smithii	4											
A. spicatum		3			4	5	5		5			
Balsamorhiza sagittata	4	4			4			3		4		
Lupinus (argenteus, holosericeus, caudatus)	6				4	5		4	4		5	5
Stipa comata		4						5				
Festuca idahoensis		5	4	3	3	4	5	4	4	4	3	4
Poa (POFE & POSA)		4										
Hackelia patens		4	5	4	4							
Senecio integerrimus		4										
Poa pratensis			4									
Carex hoodii			4				4				4	3
C. vallicola			4				5	5		5		
Antennaria rosea			4									
Holodiscus dumosus			5									
Lithospermum ruderale			5									
Penstemon (speciosa, watsoni)				5	5	4	5					
Vicia americana				5								
Elymus cinereus					4							
Eriogonum umbellatum & heracleoides					4	4		3	5		5	
Artemisia ludoviciana					4							
Rosa woodsii						5						
Collomia linearis						4		4	4			
Linanthastrum nuttallii						4	4	3		4	2	
Crepis acuminata						5						
Comandra pallida						5						
Prunus virginiana						3				4		
Leucopoa kingii							5		5			
Penstemon pratense							5	5				5
Stipa columbiana							5	5				
Carex brevipes & rossii							5		4			
Agropyron trachycaulum							5			5		
Leptodactylon pungens									4			
Eriogonum microthecum									5			
Tetradymia canescens									5			
Juniperus communis									3			
Sitanion hystrix									5		5	
Bromus marginatus										3		3
Carex sp.												4
C. multicostata										4	4	5
Melica bulbosa										5		
Hackelia floribunda										5	5	
Helianthella uniflora										5		
Phacelia hastata										5		
Agastache urticifolia										5		
Polygonum phytolaceaefolium										5		
Potentilla glandulosa											4	
Hellenium hoopesii											5	
Geranium viscosissimum											6	
Phleum alpinum												5
Potentilla fruticosa												5
Delphinium diversifolium												5

1 = 51-100%; 2 = 26-50%; 3 = 13-25%; 4 = 6-12%; 5 = 1-6%; 6 = under 1%.

B. Curlleaf Mahogany Communities

Curlleaf mahogany (Cercocarpus ledifolius) is widespread in the Great Basin and adjacent areas. Extensive areas of curlleaf mahogany are found on mountain ranges of Nevada. Tidestrom (1925) represents the species as forming "a conspicuous belt between the pinyon and the white pine colonies." The species is abundant in Lamoille Canyon and other portions of the Ruby and East Humboldt Mountains. Extensive stands of the type are found in Mitchell Canyon near the south end of the Ruby Range.

In Lamoille Canyon mahogany types form part of the mosaic of types and plant communities common to the mountain brush-aspen vegetation zone. The species occurs in alternate strips with aspen on the north aspect of lower Lamoille Canyon and in sizable stands on the south-facing slopes. The elevational range in Lamoille Canyon is between 6800 and 8500 feet depending on the aspect.

1. Stand and Understory Characteristics

Understory of curlleaf mahogany depends on site quality and thickness of the stand. On sites where the trees are taller and farther spaced, a fair understory is generally found. This type of stand is characteristic of stands on toe slopes and swales where soils are deeper. Where canopy percentage is high, understory vegetation may be very sparse. Stands growing on rock outcrops may have practically no understory vegetation. A study stand on the north face below the scout camp in Lamoille Canyon was estimated to be 1000 pounds per acre of lush forbs, shrubs, and grass. On the south face with shallower soils and drier habitat, the understory production was estimated to be less than 100 pounds of airdry herbage per acre. Both of these stands had a medium stand and canopy. Scheldt and Tisdale (1970) in analyzing curlleaf mahogany stands in Idaho found an average stand number of 427 stems per acre. The trees average 9.1 feet in height with a canopy cover of 55 percent. Some of the stand studied by the author in the Wheeler Peak area had as many as 1100 stems per acre and range in size near base from 3 to 10 inches. The understory was very sparse in such stands. One stand on a steep south-facing outcrop supported no understory except for an occasional plant of such dry site species as Erigeron pumilus, Cryptantha humilis, and Machaeranthera leucanthemifolia.

The curlleaf mahogany type is not too important for domestic livestock grazing but may be one of the more important ones for big game. Mitchell (1951) listed Cercocarpus ledifolius as one of the three major species of the winter diet of big game in eastern Washington. Heavy use of the type resulted in removal of all available leaves within reach of the grazing animals. Grazing use often results in umbrella shape trees. Thompson (1970) in Utah and Phillips (1970) in Idaho indicate that top pruning may have possibilities for increasing available forage.

Mahogany was found growing on a variety of soils. On the north-facing slope the soil had a thick, very dark A horizon lying directly over a yellow brown C horizon. The texture varied from a fine sandy loam to silt loam in the A horizon to gravelly-cobbly sandy clay loam in the C horizon. The soil temperature 70° on the surface and 48° at 20 inches. This is not typical of mahogany soils which are generally characterized by dry, warm sites.

Soils on the south aspects were much shallower and with a high percent of skeleton material. On rocky outcrops most of the roots are in the fractures in the bedrock and only a very shallow soil is evident. One common characteristic of the soils of the mahogany type is the very dark color of the surface horizon.

Curled leaf mahogany appears to have a strong affinity for soil from limestone parent material. However, such parent materials are not an absolute requirement because mahogany sites studied in the Wheeler Peak area were on quartzites.

TABLE 3

More important species found in 10 curlleaf mahogany study sites.

	Occcurrence in Study Sites	Average Percent Per Occurrence
Berberis repens	7	5
Balsamorhiza sagittata	6	16
Elymus cinereus	6	15
Symphoricarpos oreophilus	5	13
Bromus tectorum	4	3
Stipa comata	4	3
Agropyron spicatum	4	3
Carex rossii	4	1
Prunus virginiana	3	27
Artemisia tridentata	3	4
Stipa columbiana	3	3
Linanthastrum nuttallii	3	2
Hackelia patens	3	1
Eriogonum umbellatum	3	1
Senecio integerrimus	3	1
Bromus marginatus	3	1-
Phacelia sericea	3	1-
Elymus glaucus	2	10
Phacelia hastata	2	5
Poa nervosa	2	4
Agastache urticifolia	2	3
Stellaria jamesiana	2	2
Helianthella uniflora	2	2
Danthonia californica	2	2
Eriogonum heracleoides	2	1
Poa fendleriana	2	1
Artemisia ludoviciana	2	1
Descurainia richardsonii	2	1
Oryzopsis hymenoides	2	1
Rosa woodsii	2	1
Holodiscus dumosus	2	1

A total of 90 species were found associated with the mahogany type in Lamoille Canyon plus two sites near the AEC tunnel on the east slope of the Ruby Mountains. Species found at only one site were not listed in Table 3. The difference in understory species on northerly and southerly slopes is very striking. A number of species common to the aspen understory were common under the mahogany on the northerly slope. Prunus virginiana was thick wherever the mahogany canopy was open. Under the mahogany were such species as Agastache urticifolia, Nemophila breviflora, Mertensia ciliata, Carex hoodii, Hackelia jessicae, Poa nervosa, Symphoricarpos oreophilus, and Phacelia sericea. On the dryer south face additional species of Gayophytum nuttallii, Polygonum douglasii, Gilia tenerrima, Machaeranthera leucanthemifolia, Chrysopsis villosa, Physaria chambersii, and Sedum debile. On a damp spot in the mahogany Monolepis pusilla and Mimulus suksdorfii were found growing.

C. Snowbush Communities

Only a few small clumps of snowbush (Ceanothus velutinus) were observed in Lamoille Canyon, but the community was found to be common on the Ruby and East Humboldt Mountains. Extensive patches are present throughout the mountain brush zone where it occurs in nearly pure stands. This shrub is very common in the northwest where it comes in after fire. Here it is generally a member of seral shrub communities. In the Ruby Mountains snowbush apparently forms a permanent type.

A considerable number of studies have been made of this species in timber country where it competes with the establishment of young trees but little information is available on the permanent type. Its reproduction is geared to fire in that the seeds are largely dependent on heat to crack the hard seed coat. Gratkowski (1961) says that "in the absence of fire seeds may remain in forest litter for several hundred years."

Mueggler (1965) studied the species in north Idaho. He found that the species may dominate burned areas for decades after fire destroys the mesic forests.

Snowbush appears to be a very persistent type in the Ruby and East Humboldt Mountains. However, studies of its life history are lacking. It has been subject to damage by low temperatures if not protected by snow cover. In recent years tops were observed to have been killed back by frost which was followed by resprouting from the crown.

Zavitkovski and Newton (1968), in characterizing the growth habits of snowbush, say its height and biomass tends to level off at ten years of age. They found that a mature stand contained about 1000 plants per acre with a biomass (includes roots) of 24 ton per acre. These studies were made on the west slope of the Cascades and may not apply to our area, but they do give some idea of the high productivity of the type.

Vegetation Characteristics

In the Ruby-East Humboldt area the snowbush dominates the site - but other species grow in the openings. Where the brush is thick most other species are largely excluded. No characteristic species were observed to be associated with the snowbush. Species from adjacent plant communities extend into the type. On the dryer sites species commonly associated with sagebrush will be common. At higher, more mesic sites tall forbs and grasses such as Agropyron trachycaulum are common.

In two study sites - No. 1 near the AEC Tunnel near the Ruby Guard Station, and No. 2 near the American Beauty Mine in Long Canyon - associated species lists with their importance (1-6) were made. Following are the lists:

TABLE 4

	Site 1	Site 2
Prunus virginiana	3	
Cercocarpus ledifolius	5	
Lupinus argenteus (openings)	4	6
Stipa comata	5	
Balsamorhiza sagittata	5	
Elymus cinereus	6	2
Solidago sp.	5	
Carex rossii	5	6
Agropyron trachycaulum	6	
Epilobium sp.	6	
Berberis repens	5	
Machaeranthera sp.	6	
Aster chilensis	6	
Polygonum douglasii	5	
Stipa columbiana	5	
Amelanchier alnifolia	6	6
Symphoricarpos oreophilus	5	5
Stipa lettermani	6	
Chrysothamnus viscidiflorus	6	
Phacelia sp.	6	
Agastache urticifolia	6	
Artemisia tridentata		4
Descurainia sp.		6
Stipa sp.		4
Eriogonum umbellatum		6
Smilacina stellata		6
Agropyron spicatum		5
Senecio multilobatus		6

Limited data from the snowbush communities indicate a heavy organic surface mulch and a very dark, moderately thick A horizon as characteristic of the soils. The organic surface is a result of a very

heavy litter fall (leaves and stems) in the Ceanothus community (Zavitkovski and Newton 1968). The same authors say the species favor light, well aerated soils. Also, it is able to grow on and improve infertile soils.

Several authors have demonstrated the ability of snowbush plants to fix atmospheric nitrogen (Zavitkovski and Newton 1968, plus their citations of Wahlenberg 1930, Wollum 1962, Wollum and Youngberg 1964-1965). The latter authors estimated that nitrogen fixation of snowbush exceeded 70 pounds per acre. Nodule formation on the roots increases with age.

The use that grazing animals make of the snowbush community depends on the accessibility (thick stands may discourage use by domestic livestock) and location. Domestic stock make little or no use of the snowbush itself but where accessible associated species are grazed. Deer make use of the type for both resting and grazing. They like the domestic livestock grazing the associated species.

D. Aspen Communities

Aspen forests in western United States reach their greatest development in central Utah. From there the type extends into the high mountain habitat of the adjoining states of the Great and Colorado Basins. In Nevada aspen is less extensive but is common in the more mesic mountain sites of Basin ranges. The Ruby and East Humboldt Ranges of Nevada have extensive areas of aspen cover except for the southern third of the Ruby Mountains where it is confined mainly to drainage bottoms. About 25 percent of the area from Lamoille Canyon to Secret Pass was classified as aspen type by the range analysis crew.

In Lamoille Canyon where most of the vegetation studies were made, aspen was found from 6500 to 8800 feet elevation. Except for the canyon bottoms most of the aspen types were found on northeast, north, and northwest aspects. However, some coves with southwest aspects also supported aspen groves. The aspen types occupy similar positions throughout the northern Rubies and East Humboldt Mountains.

In classifying the vegetation zones of Lamoille Canyon the aspen types were included in the mountain brush zone. This was because the aspen communities did not form a distinct zone, but were intermixed with the various brush communities, each of which occupies its distinct habitat site.

Except along stream courses and particularly favorable sites the aspen trees are very scrubby. In Lamoille Canyon and Ruby-East Humboldt Mountains many trees are from six to eight feet in height and up to four inches in diameter. These groves of low aspen are called snowbank aspen by local people. However, a number of trees in the canyon bottoms reach 40 to 50 feet in height and 8 to 10 inches in diameter.

Because of the dearth of sizable aspen, its timber value is very low in the Ruby and East Humboldt Mountains. The aspen type is, however, a very important producer of forage for both domestic livestock and big game. It is also at a premium for recreation sites.

Aspen is a permanent type in the Ruby-East Humboldt Mountains. Conifer common to the seral aspen type has only occasional occurrence.

1. Characteristics of the Aspen Stand

Aspen is a short-lived tree that reproduces almost entirely by sucker growth. Trees in the stands vary in age and size, Alder (1969). Individual trees within the stand have the ability to express dominance. This characteristic plus the constant mortality rate maintains a stand of various ages. Aspen forms clones with intraconnected roots. Individual trees within the clones have a common inheritance, therefore, its phenological and other characteristics are uniform. This uniformity may not be found between the clones. Suckers grow from the points where the roots come nearest the surface. Aspen will occasionally produce viable seed (Cottam 1954, Morgan 1969), and seedlings from seed (Ellison 1943).

Alder (1969), in his study of age provile of aspen, determined the average tree age within his plots to be 68.7 years with an average diameter of 10.4 inches and an average height of 63.7 feet. His tallest tree was 92 feet and oldest tree 145 years. These measurements were made in the heart of the prime aspen country of the Intermountain area. Very few of the aspen sites in Lamoille Canyon or the Ruby-East Humboldt Mountains would fit in the Alder profile. The low aspen types are obviously growing on sites of low tree potential.

Soils under aspen are generally of high quality. They can be characterized by their thick, friable, humic A horizons, with generally little textural development in the B horizon. Aspen soils are higher in organic matter than adjoining conifer, herb-shrub, or grasslands (Tew 1968, Morgan 1969). Morgan also found more available water and higher base exchange capacity in the A horizon in aspen soils than in adjoining spruce-fir or grassland soils. Aspen is considered to be a soil improving species and very effective in nutrient cycling.

More productive aspen sites in central Utah had A horizons of 18 to 36 inches thick. In comparison aspen soils studied in Lamoille Canyon and the Ruby Mountains had A horizons varying from 8 to 25 inches in thickness. The deeper soils of the canyon bottoms and toe slopes supported normal size aspen while the shallower soils of the steeper slopes produced very low growing trees. Regardless of the site, however, the soils have a relatively thick, very dark brown surface typical of soils found under aspen. Probably the main difference between soil producing the normal size aspen and scrubby size aspen is the shallower A horizon and total soil depth under the scrubby trees.

Studies over the last few years indicate that aspen is a heavy user of soil water. In comparing water use by adjacent plant communities, Brown and Thompson (1965) found that aspen was the heaviest water user followed by spruce and grasslands. Croft and Monninger (1953) found that by removing a thick stand of aspen and leaving the herbaceous understory intact, an estimated four inches of water was conserved in the soil by reduced evapo-transpiration. Reduction of the moisture depletion by removal of aspen is only temporary (Tew 1967). Sheep Creek studies on the Fishlake National Forest show the difficulties involved in controlling aspen growth because of the persistent sprouting after cutting or defoliation by herbicide spray. Aspen was found to be a very persistent type and that type conversion would be a costly operation.

Aspen's heavy use of water is tied to the tree's deep rooting habits. Gifford (1966) found that aspen roots may extend below a 9-foot depth. Most of the aspen roots occupy the same soil depth as the herbaceous understory. Much of the moisture drain, however, was from below the four-foot level. Aspen can also draw water laterally through the connected roots of the clone.

Removal of aspen also has detrimental effects on the soil and watershed. Tew (1968) thinks that aspen removal would probably be followed by a reduction in organic matter content of the soil. This in turn would reduce the moisture holding capacity, aggregation, and porosity of the soil. Marston and Julander (1961) found that removal of aspen had considerable impact on the understory vegetation. At first there was an increase in the herbaceous vegetation. This was followed by decrease and a change in composition. Bare ground and annuals began to show up in the treated areas. These authors attributed much of the change to the increase in pocket gophers (Thomomys talpoides) on the treated site.

2. Herbaceous Understory

The understory of aspen is usually characterized by a lush, herbaceous cover. Tall forbs are conspicuous and generally constitute the bulk of the understory vegetation. In 32 study sites rated in Good to Excellent Condition forbs made up 62 percent, grasses 2 percent, and shrubs 17 percent, USFS (1970). Houston (1954) considers a strong understory of grass as an indicator of overgrazing by sheep. Harper and McNulty (1970) made comparative studies by low, mid, and high elevation. They found that woody species and graminoides were much more common at low elevations than at mid or high elevations. At high and mid elevation forbs made up nearly two-thirds of the relative composition, with grasses and sedges 12 percent, and woody species about 22 percent.

Most Important Species Found in the Aspen Understory in Ten Study Sites - Mostly from Lamoille Canyon

	Occurrence No. of Sites	Average % Composition Per Occurrence
Bromus polyanthus	8	11
Symphoricarpos oreophilus	7	10
Linanthastrum nuttallii	3	20
Thalictrum fendleri	6	9
Agropyron trachycaulum	5	9
Lupinus argenteus	4	8
Elymus glaucus	2	11
Agastache urticifolia	4	5
Berberis repens	2	10
Castilleja miniata	6	2
Stipa columbiana	3	3
Aster spp.	4	2
Osmorhiza occidentalis	3	3
Geranium richardsonii	3	2
Prunus virginiana	3	2
Delphinium occidentalis	2	3

Other important species found associated with the tall aspen types of the canyon bottoms were Aquilegia formosa, Thalictrum fendleri, Valeriana occidentalis, Aconitum columbianum, Lonicera involucrata, Thermopsis montana, Smilacina stellata, and Aster perelegans. Collomia linearis was common but not in quantity as was Descurainia richardsonii. Some species common around aspen edges and openings were Helianthella uniflora, Senecio multilobatus, S. crassulus, Monardella odoratissima, Geranium viscosissimum, and Thlaspi fendleri.

3. Production and Grazing Potential

The aspen type is a very important producer of forage for big game and domestic stock. Mature aspen with a herbaceous understory in Fair to Excellent condition will generally produce from 1000 to 1800 pounds per acre of airdry forage. Records of over two tons has been measured in the most productive sites. Harper and McNulty (1970) determined production under both stable and seral aspen communities at low, moderate and high elevations. Production varied from 1245 pounds at low elevation, to 1581 pounds at mid elevation, to 1142 pounds at high elevation in the stable aspen types. Production in seral aspen types was 477 pounds, 560 pounds, and 391 pounds from low to high elevations.

Production was estimated from 1150 to 1400 pounds per acre on the basis of soil characteristics on the ten study sites of the Ruby Mountains.

C. Alpine-Subalpine

1. Alpine

The alpine does not exist as a definite zone on the Ruby Mountains. Rather, open alpine areas are freely mixed with subalpine conifer types. Peaks extend upward to 11,387 feet in elevation which is ordinarily well above timberline - bare rock at the upper reaches prevents any definite expression of that line. On Wheeler Peak, some 200 miles south of the higher portions of the Rubies, timber extended to an elevation of 11,000 feet. Timberline is considered as a relatively reliable boundary between alpine and subalpine (Billings and Mooney 1968).

Regardless of this lack of distinction between alpine and subalpine, the Ruby-East Humboldt complex is quite rich in alpine species. Loope (1969) says that the Ruby Mountains have the richest alpine flora of the mountains of the Great Basin. He recorded 41 arctic-alpine species which he used as a basis for comparison with other mountains. In addition, there are numerous alpine species of the Western Cordilleran System present. After making a comparative check of the Ruby-East Humboldt species list with Polunin's Circumpolar Arctic list, 69 species were found to be either fully or partially comparable. In a number of instances Rocky Mountain forms are represented in our area (see Table V). A number of additional species that are either alpine or extend into the alpine are listed in Table VI.

Most of the species in Table VI have either Rocky Mountain or Western Cordillera affinities and extend either to Canada or Alaska.

Loope (1969) compared the Arctic-Alpine flora of the Ruby Mountains with that of the Beartooth Mountains. He listed 41 circumpolar species on the Ruby Mountains as compared with 89 on the Beartooth Mountains. This is somewhat less than the list in Table V which shows 69 species in common with Polunin's list. However, 20 of the arctic-alpine species listed are considered Cordilleran forms of the species. The Uinta Mountains in Utah are also rich in circumpolar species with 88 species in common with Polunin's list.

a. Alpine communities

Alpine communities are not well defined in Lamoille Canyon or in the Ruby Mountains. However, Loope (1969) characterized a number of communities. The most important ones are the alpine turf and alpine tundra. The alpine turf was found on the gently sloping north exposures of cirques and were mesic in moisture characteristics. Dominant species were dwarf Salix and Carex elynoides.

Alpine tundra was found on old erosion surfaces at 10,300 to 10,800 feet and considerably above the cirques. Such species as Silene acaulis, Phlox pulvinata, and Geum rossii are abundant on the alpine turf.

Alpine plants occur on a number of other high elevation sites from dry ridges and passes to seeps and wet meadows. However, most of the wet meadows are in the cirque bottoms and streamsides and are closely associated with the subalpine conifer types. The dry ridges and passes are the most xeric of the sites with such species as Phlox pulvinata, Eriogonum kingii, Antennaria rosea, and Geum rossii. A moss was also observed to be an important member of the plant community at Liberty Pass. Potentilla fruticosa is dominant in many alpine sites as well as in the subalpine and even lower elevations.

Information on soils is limited. DeVon Nelson analyzed six soil pits in the head of Lamoille Canyon, four of which had alpine vegetation. The soils were generally shallow, all but one was 16 inches or less in depth. Soil textures were loam and sandy loams. The landforms were hummocky slopes and ridgetops with numerous rock outcrops. Dominant species at the soil pits were Geum rossii, Antennaria rosea, Potentilla diversifolia, Phlox pulvinata, Potentilla fruticosa, and Juncus drummondii.

2. Subalpine

a. Conifer communities

Two tree species characterize the subalpine conifer type in Lamoille Canyon. Limber pine (Pinus flexilis) is most common at the lower edge of the conifer zone with the whitebark pine (Pinus albicaulis) extending to the higher elevation. In between there is considerable mixing of the two species. The bulk of the limber pine is found between 8000 and 9000 feet while whitebark pine extends from 8500 to 10,600 feet (Loope 1969). Whitebark pine is the dominant high elevation tree in the northern Ruby and East Humboldt Mountains, while limber pine and bristlecone pine (Pinus longivita) replace it in the southern Ruby Mountains. One small grove of bristlecone pine is found in Thomas Canyon, a tributary of Lamoille Canyon.

Whitebark pine and limber pine are very similar in vegetative features. Both are 5-needle trees with a rather bushy appearance. The cones are the main identifying features. The cones of whitebark pine are about 2½ inches long. They remain closed and ultimately break up at the axis, thus shedding the seeds very slowly. Rather than falling whole the cones are generally broken before they fall from the tree. Certainly, the Clark nutcracker contributes to the breakup of the whitebark pine cones. The cones of limber pine are about 5 inches long. These cones open at maturity and are not broken up but fall whole to the base of the tree. Bristlecone pine is also a 5-needle pine, but it can be distinguished by its pendulus branches. It can also be distinguished by its winged seed while those of the other two pines are wingless.

All of these subalpine trees are very slow growing. Maturity is reached in whitebark and limber pine at from 200 to 300 years, but they may live much longer. Ordinarily these trees reach a diameter of 12-34 inches (Harlow and Harrar 1941). Bristlecone pine is a very slow grower also. It also reaches a greater age than any known tree when it grows on the more rigorous sites. The oldest tree was determined to be over 4000 years old (Billings and Thompson 1957). A tree from Wheeler Peak was determined to be 4700 years old (Currey 1965).

Limber pine grows in a variety of habitats from stream banks at lower elevation to dry slopes in the subalpine zone. Scattered stands are found with aspen and high elevation sagebrush. It is also found in mixtures with the whitebark and bristlecone pine. Whitebark pine tends to occur on canyon slopes and rocky ridges, generally on shallow soils. Loope (1969) thinks perhaps it is restricted to these sites by competition from shrubs and herbs.

A number of herbaceous plant communities occur in rather close association with the subalpine conifer; very few of these communities are influenced by the conifer but they do form a part of the vegetation pattern of the subalpine zone. Some of the more important vegetation types are meadows, shrub, tall forb, and grass-forb. Some shrubby and herbaceous species are found under the trees. Vaccinium caespitosum and Arnica cordifolia are the more common species.

b. Meadow communities

Meadows are found in cirque basins, along streams, and seeps, and around lakes. The sites vary from boggy to damp. Carex scopulorum is the most common wet meadow species of the subalpine zone of the north Ruby and East Humboldt Mountains. The wet meadow communities of the Lamoille Canyon cirques are characteristic of these mountains. A cross section of a lakeside meadow progresses from open water occupied by such water plants as Isoetes bolanderi, Rorippa obtusa, and Callitriche verna to Carex scopulorum at the lake edge to C. saxatilis to C. luzulina. The damp meadow surrounding the lake contains a mixture of species consisting of Caltha leptosepala, Erigeron caespitosus, E. calyanthemus, Mimulus primuloides, Carex luzulina, C. aquatilis, C. pseudoscirpoidea, and Deschampsia caespitosa. Surrounding the meadow is the Salix-Ligusticum community which will be described later. The width of the vegetation zones surrounding the lake depends on steepness of slope extending from the water edge. Where it is steep these zones may be very narrow. Where a gentle slope occurs extensive areas of meadow dominated by Carex scopulorum are common.

A bog site in the head of Lamoille Canyon was characterized as follows: the wettest portion was occupied by Carex canescens and Eleocharis pauciflora. Species of the wet to damp meadow

surrounding the bog were Carex luzulina, Erigeron calyanthemus, Allium validum, Vaccinium caespitosum, Gentiana calycosa, Phleum alpinum, Deschampsia caespitosa, Danthonia intermedia, Caltha leptosepala, Arnica mollis, and Potentilla diversifolia, Carex scopulorum, and Pedicularis groenlandica.

The meadow communities are by far the most productive forage sites in the subalpine-alpine zone. Some of the Carex scopulorum sites were estimated up to a ton of airdry weight per acre. Not only do domestic livestock and big game make use of these meadows, but small mammals make their homes here. In some studies made with Ray Alkorn of the Bureau of Sport Fisheries and Wildlife near Favre Lake the following results were obtained: The montane meadow mouse (Microtus montanus micropus) was the most common small mammal found. It was trapped in rather wet sites with such dominant vegetation as Allium validum, Salix orestra, Veratrum californicum, and Caltha leptosepala.

The long-tailed meadow mouse (M. longicaudus) was represented by a single specimen from a damp, open forb community.

Two specimens of the big jumping mouse (Zapus princeps nevadensis) were obtained in a moist forb and Salix-Mertensia community. Also two specimens of vagrant shrew (Sorex vagrans amoenus) were from a Salix and Caltha site. One deer mouse (Peromyscus maniculatus sonoriansis) was obtained in the sidehill Salix-Ligusticum community.

c. Shrub communities

(1) Salix-Ligusticum community

The major shrub community in the subalpine zone in Lamoille Canyon is the Salix-Ligusticum community. This community is very common wherever moisture conditions are right, which is generally near stream courses, seepy sidehills, and even mesic sites. The community intermingles with the pine groves in Lamoille Canyon. The principal species of this community are Salix orestra and Ligusticum grayii. Other species listed at two observation points were Mimulus primuloides, Polygonum bistortoides, Helenium hoopseii, Valeriana occidentalis, Mertensia ciliata, Aconitum columbianum, Veratrum californicum, Erigeron callianthemus, Arnica mollis, Phleum alpinum, and Carex multicostata.

(2) Potentilla fruticosa community

This community is quite common at higher elevations in Lamoille Canyon. It occurs on mesic to seepy slopes. In addition to the Potentilla fruticosa a number of species were listed at an observation point. They were Agropyron trachycaulum,

Carex limnophilla, Helenium hoopseii, Carex stenochlaena, Trisetum spicatum, Potentilla gracilis, Artemisia ludoviciana, Polygonum bistortoides, Carex heteroneura epapillosa, Senecio cymbalarioides, and Penstemon pratensis.

Both of the shrub communities are quite productive and include many highly palatable forage plants.

d. Tall forb communities

Tall forb communities are commonly found intermixed with conifer patches in the subalpine conifer zone. Forb communities are generally found on the deeper soils on moraine or colluvial sites. Soil profiles from two sites were characterized by rather thick A horizons (24 inches) over a C horizon. The soil was classified as Pachic Cryoboroll.

The most conspicuous and often the dominant forb species of the tall forb community is Polygonum phytolaccaefolium. The reason this species is so common may be a result of heavy grazing by domestic livestock. In other words, it may be an increaser species resulting from selective grazing of more palatable plants. What part the Polygonum would play in the pristine community would be a matter of conjecture unless some pristine areas could be found. However, I think that it made up a substantial percentage of the composition of the pristine community.

Other important species found in the tall forb community are: Solidago multiradiata, Stipa columbiana, Ligusticum grayii, Potentilla diversifolia, Carex multicostata, C. rossii, Lupinus argenteus, Geum rossii, Thalictrum fendleri, Mertensia ciliata, Rudbeckia occidentalis, Erigeron calyanthemus, Aster perelegans, Agastache urticifolia, Senecio cymbalarioides, Bromus polyanthus, Frasera speciosa.

e. Alpine-subalpine ledge and rockfield communities

A number of species have a strong affinity for rocky sites. Some are crevice plants while others grow between the rocks in boulder fields and on scree. Most of the mosses are found in ledges and cliffs. Some of the fern species such as Asplenium vivide, Athyrium alpestre, Cheilanthes feei, Cryptogramma achrostichoides, C. stelleri, Pellaea breweri, Polystichium lonchitis and Woodsia scopulina are present in the study area.

Oxyria digynia is a very common boulder field plant. Others common to the same habitat are Sedum rosea, Epilobium alpinum, Arnica chamissonis, Senecio cymbalarioides, and Potentilla diversifolia. Eriophyllum lanatum is found on high gravelly slopes as well as at mid-elevations. Petrophytum caespitosum and Eupatorium occidentale were found growing on rock surfaces where they had collected their own little soil patches. Cymopterus humboldtensis, Draba nivalis, D. oligosperma are also found from crevices and rocky slopes. Selaginella watsoni, one of the club mosses, is often found growing between rocks where shallow soil accumulations are found.

TABLE V

Species found in the Ruby - East Humboldt Mountains
and
listed in Polunin's Circumpolar Arctic Flora

Botrychium lunaria
Athyrium alpestre
Asplenium vivide
Cryptogramma stelleri
Cystopterus fragilis
Polystichium lonchitis
Equisetum arvense
Selaginella selaginoides
Potamogeton alpinus
Triglochin palustris
Agropyron trachycaulum
Agoseris scabra
Calamagrostis canadensis (var.)
C. purpurascens
Deschampsia caespitosa
Festuca ovina
F. ovina brachyphylla
Hierochloe odorata
Poa alpina
P. arctica
Phleum alpinum
Trisetum spicatum
Carex aquatilis
C. brunnescens
C. canescens
C. capillaris
C. rostrata
C. saxatilis
Eleocharis pauciflorus
Luzula spicata
L. parviflora
Lloydia serotina
Zigadenus elegans
Habenaria hyperborea
Salix arctica
S. myrtillifolia (var.)
Oxyria digyna
Polygonum viviparum
Arenaria obtusiloba
Sagina saginoides (var. hesperia)
Silene acaulis (var. subacaulescens)
Thalictrum alpinum
Arabis holboellii (var.)
Draba crassifolia
D. nivalis (var. exigua)
Smelowskia calycina (var. americana)
Sedum rosea (var. integrifolium)
Saxifraga caespitosa (var. exaratoides)
S. cernua
Geum rossii (var. turbinatum)
Potentilla fruticosa
Sibbaldia procumbens
Epilobium laterifolium
Astragalus aboriginum (as part of A. australis)
A. alpinus
Calitriche verna
Viola adunca (as part of laboridorica)
Shepherdia canadensis
Epilobium alpinum (var. nutans)
Arctostaphylos uva-ursi
Kalmia polifolia (var. microphylla)
Androsace septentrionalis (var.)
Gentiana tenella
Polemonium pulcherrimum (var.)
Pedicularis groenlandica
Veronica wormskjoldii (var.)
Galium aparine
Achillea millefolium (ssp. and var.)
Solidago multiradiata

TABLE VI

Species that are alpine or extending into the alpine but not Circumpolar Arctic plants

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Selaginella watsoni
Juniperus communis
Agrostis humilis
Poa epilis
P. nervosa
P. sandbergii
Stipa pinetorum
Carex albo-nigra
C. ebenea
C. elynoides
C. haydeniana
C. heteronerua epapillosa
C. nigricans
C. pelocarpa
C. phaeocaephala
C. pseudoscirpoidea
C. scopulorum
C. subnigricans
Juncus drummondii
J. mertensiana
J. parryi
Luzula intermedia
Salix nivalis
Eriogonum kingii
E. umbellatum porteri
Polygonum minimum
Claytonia lanceolata
Lewisia pygmaea
Montia hallii
Arenaria aculeata
Caltha letposepala
Ranunculus alismaefolia
R. escholtzii
Arabis fernaldinan stylosa
A. lemmoni
A. lyallii
A. platysperma
Draba nivalis elongata
D. stenoloba
D. sphaeroides
Rorippa obtusa
Sedum debile
S. stenopetalum
Ribes montigenum
Saxifraga adscendens oregonensis
S. debilis
S. odontoloma
S. rhomboides
S. tolmiei
Potentilla breweri
P. concinna
P. diversifolia
P. drummondii
Astragalus tegetarius
Oxytropis viscida
Trifolium monanthum
Epilobium obcordatum
Polemonium viscosum
Pteryxia hendersonii
Cymopterus humboldtensis
Primula parryi
Gentiana calycosa asepala
Gilia congesta montanum
Phlox pulvinata
Mimulus tillingii
M. primuloides
Penstemon humilis
Aster alpigenus haydenii
Erigeron tenor
Haplopappus macronema
Senecio canus
S. amplectens holmii

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SPECIES LIST

Ruby and East Humboldt Mountains

Species	Frequency	Habitat Site	Location	Zones: Valley	P-J	Mt. Brush	Aspen	Subal.-Con.	Alpine
BRYOPHYTA - Moss F.									
Brachythecium frigidum (C.M.) Besch.(=B. asperrimum (Mitt.) Sul.; B.lamprochryseum C.Muell.	Freq.	Streamside	L					x	
OPHIOGLOSSACEAE - Grapefern F.									
Botrychium lunaria (I.) Sw. var. minganense(Vict.)Dole B.m.Vict.	Rare	Moist slopes	R					x	x
POLYPODIACEAE - Fern F.									
Asplenium viride Huds.	Rare	Limestone cliffs	R					x	x
Athyrium alpestre (Hoppe) Rylands var. americana Butters	Occas	Talus & rocky slopes	L					x	x
A. felix-femina (L.) Roth var. californicum Butters	Occas	Streamside cove	R			x			
Cheilanthes feei Moore	Occas	Ledges	R			x			
Cryptogramma acrostichoides R.Br.	Freq	Ledges and cliffs	R					x	x
C. stelleri (Gmel.) Prantl	Rare	Ledges	L					x	x
Cystopterus fragilis Bernh.	Occas	Moist sites	L			x	x	x	x
Pellaea breweri D. C. Eaton	Freq	Cliffs and ledges	R					x	x
Polystichum lonchitis (L.) Roth	Occas	Talus, shade	R					x	x
Woodsia scopulina D. C. Eaton	Freq	Talus slopes	L					x	x
Pteridium aquilinum (L.) Kuhn var. lanuginosum (Bong.) Fern	L.Abund	Aspen understory	R			x	x		
EQUISETACEAE - Horsetail F.									
Equisetum arvense L.	Rare	Wet sites	L			x	x		
ISOETACEAE - Quillwort F.									
Isoetes bolanderi Engelm.	Freq	Ponds and lakes	R					x	
SELAGINELLACEAE - Selaginella F.									
Sellaginella selaginoides (L.) Link	Rare	Moist sites	R					x	
S. watsoni Underw.	Freq	Dry ridges & slopes	L					x	x
PINACEAE - Pine F.									
Abies concolor Lindl.	Local	Strand sp., (Seitz Can.)	R					x	
Picea engelmannii (Parry) Engelm.	Local	Strand sp., (Thorpe Can.)	R					x	
Pinus albicaulis Engelm.	Common	Highest conifer community	L					x	
P. aristata Engelm.	Local	High raw slopes	L					x	x

L = Lamoille Canyon
R = Ruby-East Humboldt Mtns.

June 1971

SPECIES LIST

Ruby and East Humboldt Mountains

Species	Frequency	Habitat Site	Location	Zones: Valley	P-J	Mt. Brush	Aspen	Subal.-Con.	Alpine
Pinus flexilis James	Common	Upper slopes	L					x	
P. monophylla Torr. & Frem.	Occas	Dry-warm foothills	L		x				
Pseudotsuga menziesii var. glauca (Beissn.) Franco	Local	Local planting	L				x		
CUPRESSACEAE - Cypress F.									
Juniperus communis L. var. saxatilis Pall.	Occas	Dry slopes	L			x			
J. osteosperma (Torr.) Little	L.Abund	Dry, warm slopes	R		x	x			
J. scopulorum Sarg.	Occas	Canyon bottoms	L			x			
SPARAGANIACEAE - Burreed F.									
Sparganium angustifolium Michx.	Occas	Lake aquatic	R					x	x
POTAMOGETONACEAE - Pondweed F.									
Potamogeton alpinus Balbis	Occas	Standing & running water						x	x
P. gramineus L.	Freq	Standing & running water	R	x	x				
JUNCAGINACEAE - Arrowgrass F.									
Triglochin palustris L.	Occas	Marshy areas, lakes	R					x	
T. maritima L.	Occas	Marshy areas				x	x		
GRAMINEAE - Grass F. Festuceae Tribe									
Bromus anomalus Rupr.	Occas	Aspen and brush types	L			x	x		
B. inermis Leyss.	Occas	Seedings	L			x	x		
B. marginatus Nees	Freq	Aspen & brush community	L			x	x		
B. polyanthus Scribn.	Freq	Aspen & brush community	L			x	x		
B. tectorum L.	Freq	Dry slopes	L	x	x	x	x		
Festuca idahoensis Elmer	Freq	Sage-grass community	L			x			
F. ovina L. var. ovina	Occas	Sage-grass & open conifer	L			x		x	
F. ovina L. var. brachyphylla (Schult.) Piper	Occas	Alpine turf	R						x
Glyceria elata (Nash.) Batchelder	Local	Streamside	R			x	x		
G. striata (Lam.) A. S. Hitchc.	Occas	Damp sites	L			x			
Leucopoa kingii (S.Wats.) Weber	Occas	Dry, open slopes	L			x	x		
Melica bulbosa Geyer	Occas	Open hillsides	L			x	x		
Poa alpina L.	Occas	Damp meadows	R				x	x	x
P. ampla Merr.	Occas	Mahogany community	L			x			
P. arctica R. Br.	Rare	Damp meadow (Virdi L.)	R						x
P. bulbosa L.	Occas	Disturbed area	L			x			
P. epilis Scribn.	Occas	Open slopes & dry meadow	L			x		x	x

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SPECIES LIST

Ruby and East Humboldt Mountains

Species	Frequency	Habitat Site	Location	Zones: Valley	P-J	Mt. Brush	Aspen	Subal.-Con.	Alpine
Poa fendleriana (Steud.) Vasey	Freq	Open parks & sage-grass	L			x	x	x	
P. juncifolia Scribn.	Occas	Sagebrush community	R			x			
P. nervosa (Hook.) Vasey	Occas	Woodland & meadows	L			x	x		
P. nevadensis Vasey	Occas	Dry meadows	L				x		
P. palustris L.	Occas	Open conifer	L					x	
P. pratense L.	Freq	Dry meadows	L			x	x		
P. reflexa Vasey & Scribn.	Occas	Damp, open timber	L					x	
P. rupicola Nash	Occas	Alpine turf	L					x	x
P. sandbergii Vasey	Freq	Open slopes	L		x	x	x	x	x
Hordeae Tribe									
Agropyron smithii Rydb.	Freq	Sagebrush flats	L			x			
A. spicatum (Pursh)Scribn.& Smith var. spicatum	Common	Sage-grass community	L			x			
A. subsecundum (Link.) A.S.Hitchc.	Freq	Woodland	L			x	x		
A. trachycaulum (Link.) Malte	Freq	Woodland & sagebrush	L			x	x	x	
Elymus cinereus Scribn. & Merr.	Freq	Sage-grass community	L			x	x		
E. glaucus Buckl.	Freq	Woodland	L			x	x		
Hordeum brachyantherum Nevski	Occas	Meadows	R				x	x	
Sitanion hystrix(Nutt.)J.G.Smith	Freq	Open slopes	L		x	x	x	x	x
Aveneae Tribe									
Danthonia californica Boland	Occas	Open brush	R			x			
D. intermedia Vasey	Freq	Moist sites & meadows	L			x	x		
D. unispicata Munro	Freq	Scabby areas	L			x	x	x	
Deschampsia caespitosa (L.)	Freq	Meadows	L				x	x	
Trisetum spicatum (L.) Richt.	Freq	Open slopes	L				x	x	
Agrostideae Tribe									
Agrostis alba L.	Local	Meadows	R			x	x		
A. exarata Trin.	Occas	Damp woods	L			x	x		
A. humilis Vasey	Freq	Meadows	L				x	x	
A. scabra Willd.	Freq	Wet sites	L				x	x	
Aristideae Tribe									
Calamagrostis canadensis (Michx.) Beauv. var. canadensis	Occas	Stream edge	L			x	x		
C. purpurascens R. Br.	Occas	Open areas	L					x	x
Muhlenbergia filiformis (Thurb.) Rydb.	Occas	Meadows	L				x	x	
M. richardsonis (Trin.) Rydb.	Occas	Sage-grass community	L			x	x		
M. racemosa (Michx.) BSP	Occas	Stream edge meadows	R			x			

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Oryzopsis hymenoides (Roem & Schult.) Ricker	Occas	Sage-grass community	L			x			
O. bloomeri (Boland.) Ricker	Occas	Open ridges	R			x	x		
Phleum alpinum L.	Freq	Meadow	L					x	x
P. pratense L.	Occas	Open conifer	L					x	
Stipa columbiana Macoun	Occas	Sage-grass community	L			x	x		
S. comata Trin. & Rupr.	Occas	Sagebrush & browse types	L			x			
S. lettermani Vasey	Occas	Forb-grass	L					x	
S. pinetorum M. E. Jones	Occas	Rocky slopes	L						x
Clorideae Tribe									
Hierochloe odorata (L.) Beauv.	Occas	Wet meadows	L				x		
CYPERACEAE - Sedge F.									
Carex aquatilis Wahl.	Freq	Wet meadow	L					x	
C. albo-nigra Mack.	Occas	Alpine turf	L						x
C. atherodes Spreng.	Freq	Swampy areas	R	x					
C. aurea Nutt.	Occas	Wet meadows	R					x	
C. bella Bailey	Occas	Damp sites	R					x	
C. brevipes W. Boott.	Occas	Open timber	L					x	
C. brunnescens (Pers.) Poir.	Occas	Meadows	R				x	x	
C. canescens L.	Local	Boggy areas	L					x	
C. capilaris L.	Rare	Meadow	R				x		
C. disperma Dewey	Occas	Damp sites	L					x	
C. ebenea Rydb.	Occas	Damp meadow	R					x	
C. elynoides Holm	Occas	Alpine turf	L						x
C. festivella Mack.	Rare	Damp meadow	R			x	x	x	
C. fissuricola Mack.	Infreq	Meadows	R			x	x	x	
C. hassei Bailey	Local	Meadow	L				x		
C. haydeniana Olney	Occas	Rocky slopes	L						x
C. heteroneura W. Boott epapillosa (Mack.) F. J. Herm.	Freq	Meadows & damp sites	L			x	x	x	
C. hoodii Boott	Occas	Sage-grass community	L					x	x
C. lanuginosa Michx.	L.Abund	Wet meadows	L					x	
C. limnophila F. J. Herm.	Occas	Wet meadows	L			x	x		
C. luzulina Olney var. ablata (Bailey) F. J. Herm.	Freq	Wet meadows	L					x	
C. microptera Mack.	Freq	Meadows, streamside	L			x	x	x	
C. multicostata Mack.	Freq	Dry slopes	L				x	x	
C. nebraskensis Dewey	Local	Wet meadows	L			x			
C. nova Bailey	Occas	Meadows & streamside	R					x	
C. occidentalis Bailey	Occas	Open timber	R				x	x	
C. pelocarpa F. J. Herm.	Occas	Rocky slopes	L					x	x

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SPECIES LIST

Ruby and East Humboldt Mountains

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C. petasata Dewey	Occas	Sage-grass community	L			x			
C. phaeocephala Piper	Occas	Dry meadow	R					x	
C. pseudoscirpoidea Rydb.	Occas	Dry meadow	L					x	
C. rossii Boott	Occas	Cercocarpus community	L			x			
C. rostrata Stokes	Occas	Wet meadow	R				x		
C. saxatilis L. var. major Olney	Freq	Wet meadow	R					x	
C. saximontana Mack.	Freq	Woodland	L			x	x		
C. scopulorum Holm	Occas	Damp sites	L					x	
C. simulata Mack.	Local	Wet meadows	R	x					
C. stenochlaena (Holm) Mack.	Occas	Wet sites	L				x	x	
C. subnigricans Stacey	Local	Dry meadow - rock slope	L						x
C. vallicola Dewey	Occas	Sage-grass community	L			x			
Cyperus aristatus Rottb.	Freq	Wet sites	R	x					
Eleocharis acicularis (L.) R.&S.	L.Freq	Wet meadow	R	x				x	
E. pauciflorus (Lightf.) Link	Rare	Cold water	R					x	x
E. rostellata Torr.	Rare	Hot springs	R	x					
Scirpus microcarpus Presl.	Occas	Streamsides	R			x			
JUNCACEAE - Rush F.									
Juncus articulatus L.	Rare	Ditchbanks	L	x					
J. balticus var. montanus Engelm.	L.Abund	Wet meadows	L			x			
J. bufonis L.	Occas	Streamside meadow	R			x			
J. confusus Cov.	Freq	Sage-grass community	L				x		
J. drummondiana E. Meyer	Freq	Dry slopes, open woods	L					x	
J. longistylis Torr.	Occas	Stream edge	L				x		
J. mertensianus Bong.	Occas	Wet meadows	L				x	x	
J. parryi Engelm.	Occas	High open slope	R				x		
J. saximontana A. Nels. f. brunnescens (Ryd.) F.J.Herm.	Occas	Wet meadows	L					x	
Luzula intermedia (Thuill.)A.Nels.	Occas	Wet sites	R					x	x
L. parviflora (Ehrh.) Desv.	Freq	Damp sites	R					x	
L. spicata (L.) DC.	Occas	Dry meadows	L					x	
LILIACEAE - Lily F.									
Allium acuminatum Hook.	Occas	Sage-grass community	R			x			
A. campanulatum S. Wats.	Occas	Sage-grass community	L			x			
A. validum S. Wats.	L.Freq	Wet meadow	L					x	
Calochortus nitidus Dougl.	L.Freq	Moist sites, dry slopes	L				x	x	
C. nuttallii Torr.var. nuttallii	Occas	Dry slopes	R			x			
Lloydia serotina (L.)	Occas	Damp sites	L						x
Smilacina racemosa (L.) Desf.var. amplexicaulis (Nutt.) S. Wats.	Occas	Damp cool sites	L			x	x		
S. stellata (L.) Desf.	Occas	Wet meadows	L			x			

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Veratrum californicum Dur.	Local	Seeps and damp sites	L			x	x		
Zigadenus elegans Pursh	Occas	Meadows & seeps	L			x	x		
Z. venenosus S. Wats.	Local	Meadows	L			x	x		
IRIDACEAE - Iris F.									
Iris missouriensis Nutt.	Occas	Damp meadows	R			x	x		
Sisyrinchium idahoensis Bickn.	Occas	Meadows	R	x					
ORCHIDACEAE - Orchid F.									
Habenaria dilatata (Pursh) Hook.	Occas	Boggy areas	R				x	x	
H. hyperborea (L.) B. Br.	Occas	Wet meadow	R	x					
Corallorhiza maculata Raf.	Rare	Deep aspen woors	R				x		
C. striata Lindl.	Rare	Deep woods	R				x		
Spiranthes romanzoffiana C. & S.	Occas	Meadows	R					x	
SALIACEAE - Willow F.									
Populus angustifolia James	Freq	Lower streams	L		x	x			
P. tremuloides Michx.	Abund	Damp, cool sites	L				x		
P. trichocarpa Torr. & Gray	Freq	Streamsides	R	x		x			
Salix arctica Pall.	Occas	Boggy areas	L					x	x
S. glauca L.	Local	Moist slopes	L					x	x
S. myrtillifolia Andress.	Local	Streamsides	R			x	x		
S. nivalis Hook.	Occas	Wet sites	L						x
S. orestera Schneid.	Abund	Seeps & stream edge	L				x	x	
S. scouleriana Barrett	Occas	Shrub community	R			x			
SANTALACEAE - Sandalwood F.									
Comandra pallida A. DC.	Freq	Sage-grass community	L			x			
POLYGONACEAE - Buckwheat F.									
Eriogonum caespitosum Nutt.	Freq	Sage-grass community	L			x			
E. cernuum Nutt.	Freq	Roadside, waste areas	R			x			
E. effusum Nutt.	Freq	Dry slopes	R			x		x	
E. heracleoides Nutt.	Freq	Sage-grass community	L			x			
E. kingii Torr. & Gray	Occas	Dry slopes, endemic	L					x	x
E. microthecum Nutt. var. laxiflorum Benth.	Freq	Sage-grass community	L			x			
E. ovalifolium Nutt.	Occas	Dry slopes	R		x				
E. shockleyi Wats. ssp. candidum (Jones) Stokes	Occas	Dry mid-elevation slopes	R			x			

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Ruby and East Humboldt Mountains

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Eriogonum strictum Benth. var. anserinum (Greene) R. J. Davis	Occas	Dry soils	R			x			
E. umbellatum Torr.ssp.umbellatum	Freq	Brush types	L			x	x		
E. umbellatum Torr. var. torreyana (Gray) M. E. Jones	Occas	Brush types	L			x			
E. umbellatum Torr. var. porteri (Small) Stokes	Freq	Open slopes	R					x	x
Oxyria digyna (L.) Hill	Freq	Boulder slopes	L						x
Polygonum aviculare L.	Freq	Roadside	L			x	x	x	x
P. bistortoides Pursh var. bistortoides	Freq	Meadows	L			x	x	x	x
P. bistortoides Pursh var. linearifolium (S. Wats.) Small	Freq	Meadows	R				x	x	
P. douglasii Greene var. douglasii	Freq	Open slopes	L			x	x		
P. douglasii Greene var. johnstonii Munz	Freq	Open slopes	L			x	x		
P. minimum S. Wats.	Occas	Wet sites	L					x	x
P. persicaria L.	Occas	Streamside	L			x	x		
P. phytolaccaefolium Meisn.	Occas	Open slopes	L				x	x	
P. viviparum L.	Occas	Meadows	L						x
Rumex crispus L.	Occas	Damp sites	L			x			
CHENOPODIACEAE - Goosefoot F.									
Chenopodium album L.	Occas	Aspen community	L				x		
Eurotia lanata (Pursh) Moq.	Local	Very dry passes	R			x			
Monolepis nuttalliana (Suit.)Greene	Local	Disturbed areas	L			x			
M. pusilla Torr.	Freq	Damp sites, mahogany	L			x			
PORTULACEAE - Purslane F.									
Claytonia lanceolata Pursh	Occas	Moist sites	R				x	x	x
Lewisia pygmaea (Gray) Robins var. pygmaea	Occas	Moist sites	R					x	x
L. pygmaea (Gray) Robins var. nevadensis (Gray) Fosb.	Occas	Moist sites	R					x	x
L. rediviva Pursh	Occas	Dry slopes	R			x			
Montia hallii (Gray) Greene	Rare	Wet sites	L					x	
M. perfoliata (Donn.) Howell	Occas	Cool, damp woodland	L			x			
Spraguea umbellata Torr.	Occas	Dry rocky sites	L			x	x		
CARYOPHYLLACEAE - Pink F.									
Arenaria aculeata S. Wats.	Freq	Dry slopes	L			x		x	x

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Ruby and East Humboldt Mountains

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Arenaria kingii(S.Wats.)M.E.Jones var. uintahensis(A.Nels.)Maguire	Occas	Dry slopes	R			x		x	
A. lateriflora L.	Freq	Moist shade	R						x
A. obtusiloba (Rydb.) Fern.	Occas	Alpine turf	R					x	x
Lychnis drummondii(Hook.) S.Wats.	Occas	Open woods	R				x	x	
Silene acaulis L. ssp. subacaulescens (R.N.Williams) C. L. Hitchc. & Maguire	Freq	Rocky slopes	L						x
S. douglasii Hook.	Occas	Talus slope	L					x	
Spergularia rubra (L.)J.&C.Presl.	Freq	Roadway	L					x	
Stellaria jamesiana Torr.	Freq	Aspen&mahogany community	L			x	x		
PAEONIACEAE - Peony F.									
Paeonia brownii Dougl.	Occas	Sage-grass community	L			x			
RANUNCULACEAE - Crowfoot F.									
Aconitum columbianum Nutt.	Occas	Damp, partial shade	L				x		
Actaea rubra (Ait.) Willd. ssp. arguta (Nutt.) Hult.	Occas	Damp, partial shade	L				x		
Anemone multifida Poir.	Occas	Open ridges	R					x	
Aquilegia formosa Fisch.	Freq	Streamsides	L			x	x	x	
Caltha leptosepala DC.	Freq	Marshy meadows	L					x	
Delphinium andersoni Gray	Occas	Dry slopes & canyon	R			x			
D. depauperatum Nutt.	Occas	Rocky slopes	R		x			x	
D. diversifolium Greene	Occas	Sage-grass community	L			x		x	
D. occidentale (S.Wats.) S. Wats.	Occas	Streambanks & moist slope	R				x	x	
D. stachydeum (Gray) Tides.	Occas	Moist sites	R				x	x	
Ranunculus alismaefolius Geyer var. alismellus Gray	Freq	Meadows	R					x	
R. alismaefolius Geyer var. hartwegii (Greene) Jeps.	Freq	Meadows	R					x	x
R. alismaefolius Geyer var. montanus S. Wats.	Freq	Meadows	R					x	
R. eschscholtzii Schlecht.	Occas	Snowbank edge	R					x	
R. scleratus L. var. multifidus Nutt.	Occas	Damp meadows	L					x	
R. testiculatus Crantz	Local	Disturbed areas	L			x			
Thalictrum alpinum L.	Rare	Wet meadows	L						x
T. fendleri Engelm.	Freq	Aspen community	L				x		
BERBERIDACEAE - Barberry F.									
Berberis repens L.	Freq	Sagebrush & woodland	L			x	x		

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PAPAVERACEAE - Poppy F.									
Argemone munita Bur. & Hilg. ssp. rotundata (Rydb.) G. B. Ownbey	Occas	Dry roadsides	R	x	x				
CRUCIFERAE - Mustard F.									
Alyssum desertorum Stapf.	Occas	Sage-grass community	L			x			
Arabis fernaldiana Roll. var. stylosa (S. Wats.) Roll.	Freq	Rocky slopes (endemic)	R					x	x
A. hirsuta (L.) Scop. var. glabrata Torr. & Gray	Freq	Moist sites	L					x	x
A. holboellii Hornem. var. retrofracta (Graham) Rydb.	Freq	Sage-grass community	L				x		
A. lemmoni S. Wats.	Freq	Rocky slopes	R					x	x
A. lyallii S. Wats.	Freq	Rocky slopes	R					x	x
A. platysperma Gray	Freq	Rocky slopes	R					x	x
A. sparsiflora Nutt.	Freq	Sage-grass community	L			x			
Cardamine cordifolia Gray	Occas	Damp sites	R			x	x		
Caulanthus crassicaulis (Torr.) S. Wats.	Occas	Cercocarpus community	L			x			
Descurainia pinnata (Walt.) Britt. var. filipes (Gray) Peck	Occas	Dry slopes	R		x	x			
D. richardsonii (Sweet) O.E.Schulz var. incisa (Engelm.) Detl.	Freq	Sage-grass community	L			x			
Draba crassifolia Grah.	Occas	Moist sites	R					x	x
D. nivalis Lilj. var. exigua (O. E. Schulz) C. L. Hitchc.	Occas	Rocky areas	R					x	x
D. nivalis Lilj. var. elongata S. Wats.	Occas	Moist cliffs	R					x	x
D. oligosperma Hook. var. oligosperma	Freq	Dry slopes	R				x	x	
D. sphaeroides Payson var. sphaeroides	Local	Damp streamside	L			x			
D. stenoloba Ledeb. var. nana (Schulz) C. L. Hitchc.	Freq	Moist soils	R						x
D. ventosa Gray	Occas	Open slopes	R					x	
Erysimum capitatum (Dougl.)Greene var. capitatum	Occas	Aspen community	L				x		
E. capitatum (Dougl.) Greene var. washoensis G. Rossb.	Occas	Open slopes	L			x			
Lesquerella kingii S. Wats.	Rare	Dry slopes	R		x	x			
Nasturtium officinale R. Br.	Local	Streams	L			x	x		
Physaria chambersii Rollins var. chambersii	Occas	Brush community	L			x			

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Sisymbrium altissimum L.	Freq	Sage-grass community	L			x			
Smelowskia calycina (Steph.)Meyer	Occas	Boulder slopes	L						x
Streptanthus cordatus Nutt.	Freq	Brush community	L			x			
Subularia aquatica L.	Occas	Alpine Lakes	R						x
Thlaspi fendleri Gray var. fendleri	Occas	Aspen community	L				x		
CAPPARIDACEAE - Caper F.									
Cleome serrulata Pursh	Occas	Roadside & waste places	R	x					
CRASSULACEAE - Stonecrop F.									
Sedum debile S. Wats.	Freq	Dry, rocky sites	L			x		x	x
S. rosea (L.) Scop. var. integrifolium (Raf.) Hult.	Occas	Moist sites, ledges	L					x	x
S. stenopetalum Pursh	Freq	Dry rocky sites	L					x	x
SAXIFRAGACEAE - Saxifrage F.									
Heuchera cylindrica Dougl. var. glabella (Torr.& Gray) Wheelock	Occas	Rock cliffs	R					x	
H. parvifolia Nutt. var. utahensis (Rydb.) Garrett	Occas	Rocky areas	L				x	x	
H. rubescens Torr. var. alpicola Jeps.	Occas	Dry, open slopes	L				x	x	
Jamesia americana Torr.& Gray var. californica (Small) Jeps.	Occas	Dry cliffs	R		x	x			
Lithophragma parviflora(Hook.) Nutt.	Freq	Damp sites, sagebrush	L			x			
Parnassia fimbriata Konig var. intermedia (Rydb.)C.L. Hitchc.	Occas	Stream edges (endemic)	L				x	x	
P. kotzebuei Cham.	Occas	Alpine meadow	R						x
Ribes aureum Pursh	Occas	Canyon bottoms	L			x			
R. cereum Dougl. var. inebrians (Lindl.) C.L. Hitchc.	Freq	Open slopes & basins	L			x	x	x	
R. inerme Rydb.	Occas	Alpine turf	R						x
R. montigenum McClatchie	Freq	Open timber	R					x	
Saxifraga adscendens L. var. oregonensis (Raf.) Breit.	Occas	Rock crevices	R					x	x
S. caespitosa L. ssp. exaratoides (Simmons) Engl. & Irmsch.	Occas	Rocky areas and cliffs	R					x	
S. cernua L.	Occas	Rocky crevices & streams	L					x	
S. debilis Engelm.	Occas	Seeps and damp cliffs	L					x	x
S. integrifolia Hook. var. claytoniaefolia (Canby) Rosend.	Occas	Wet sites, shaded	L			x	x		
S. integrifolia Hook. var. columbiana (Piper) C.L. Hitchc.	L.Freq	Streamside meadow	L			x			
S. odontoloma Piper	Occas	Streamside	L					x	

L = Lamoille Canyon
R = Ruby-East Humboldt Mtns.

SPECIES LIST

Ruby and East Humboldt Mountains

Species	Frequency	Habitat Site	Location	Zones: Valley	P-J	Mt. Brush	Aspen	Subal.-Con.	Alpine
Saxifraga rhomboidea Greene	Occas	Damp, rocky areas	L						x
S. tolmiei Torr. & Gray	Rare	Meadows	R						x
ROSACEAE - Rose F.									
Amelanchier alnifolia (Nutt.)Nutt var. alnifolia	Freq	Sage-grass & browse	L			x			
A. utahensis Koehne	Freq	Dry slopes and hills	R			x			
Cercocarpus ledifolius Nutt. var. ledifolius	Abund	Mahogany community	L			x			
Crataegus douglasii Lindl.	Freq	Valley streams	R	x					
Geum macrophyllum Willd. var. perincisum (Rydb.) Raup	Occas	Thickets along streams	L			x	x		
G. rossii (R. Br.) Ser. var. turbinatum (Rydb.) A.S.Hitchc.	Freq	Open ridge - conifer type	L					x	
G. triflorum Pursh var. ciliatum (Pursh) Fassett	Occas	Damp sites, sage-grass	L				x	x	
Holodiscus dumosa (Hook.) Heller var. glabrescens (Groenm.) C. L. Hitchc.	Freq	Dry slopes, brush comm.	L			x			
Ivesia shockleyi S. Wats.	Freq	Dry, rocky slopes	L					x	
Petrophytum caespitosum (Nutt.) Rydb.	Occas	Ledge & bare rock	L				x		
Physocarpus malvaceus (Greene) Kuntz	Occas	Brush & aspen community	L			x	x		
Potentilla breweri S. Wats.	Occas	Meadows	L				x	x	
P. concinna Richards	Freq	Rocky slopes	L					x	x
P. diversifolia Lehm.	Freq	Meadows & open areas	L					x	x
P. drummondii Lehm.	Occas	Moist sites	L					x	x
P. fruticosa L.	Freq	Damp sites	L			x	x	x	
P. glandulosa Lindl. ssp. nevadensis S. Wats.	Freq	Open slopes	L			x	x		
P. glandulosa Lindl. var. pseudorupestris (Rydb.) Briet.	Occas	Open slopes	L			x	x		
P. gracilis Dougl. var. elmeri (Rydb.) Jeps.	Occas	Moist meadows	R			x	x		
P. gracilis Dougl. var. glabrata (Lehm.) C. L. Hitchc.	Freq	Meadows & slopes	R				x	x	
Prunus virginiana L. var. melanocarpa (A.Nels.) Sarg.	Freq	Canyon bottoms & slopes	R				x	x	
Purshia tridentata (Pursh) DC.	Freq	Sagebrush community	L			x			
Rosa woodsii Lindl. var. ultramontana (S. Wats.) Jeps.	Freq	Damp canyons & slopes	L			x			
Rubus idaeus L. ssp. sachalinensis (Leu.) Focke	Occas	Rock talus	R					x	
R. parviflorus Nutt.	Local	Woodland	R				x		
Sibbaldia procumbens L.	Occas	Soil patches, rocky slope	L					x	x
Sorbus scopulina Greene	Occas	Woodland and brush	R			x	x		

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SPECIES LIST

Ruby and East Humboldt Mountains

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LEGUMINOSAE - Pea F.									
Astragalus aboriginum Rich.	Rare	Rocky slopes and ridges	R					x	x
A. alpinus L.	Occas	Sage-grass community	L				x		
A. argophyllus Nutt.	Occas	Sage-grass community	R		x	x			
A. beckwithii Torr. & Gray	Occas	Sage-grass community	L			x			
A. calycosus Torr.	Occas	Lower slopes	R	x	x				
A. felipes Torr.	Occas	Sage-grass community	L			x			
A. lentiginosus Dougl. var. tremuletorum Barneby	Occas	Mt. meadows	R					x	
A. newberry Gray	Occas	Open slopes	R		x	x			
A. obscurus S. Wats.	Occas	Dry slopes	R			x	x		
A. platytropis Gray	Occas	Sage-grass	R			x			
A. purshii Dougl.	Occas	Dry slopes	R			x			
A. robbinsii (Oakes) Gray var. occidentalis S. Wats.	Freq	Streamside (endemic)	R				x	x	
A. stenophyllus Torr. & Gray	Freq	Sage-grass community	L			x			
A. tegetarius S. Wats.	Freq	Alpine turf	R						x
A. tenellus Pursh	Freq	Dry, rocky slopes	L	x	x	x			
Hedysarum boreale Nutt. var. obovatum Roll.	Occas	Open slopes (endemic)	R			x			
Lupinus argenteus Pursh var. argenteus	Freq	Sage-grass community	L			x			
L. argenteus Pursh var. parviflorus (Nutt.) C. L. Hitchc.	Occas	Sage-grass community	L			x			
L. argenteus Pursh var. stenophyllus (Nutt.) R.J. Davis	Occas	Sage-grass community	L			x			
L. argenteus Pursh var. tenellus (Dougl.) Dunn	Occas	Sage-grass community	L			x			
L. caudatus Kellogg	Freq	Sage-grass community	L			x	x		
L. holosericeus Nutt.	Freq	Sage-grass community	L			x	x		
L. laxiflorus Dougl. ssp. calcaratus (Kellogg) Dunn	Occas	Sage-grass community	R	x	x	x			
L. lepidus Dougl. var. lobbii (Gray) C. L. Hitchc.	Occas	Dry slopes	L			x			
Oxytropis viscida Nutt.	Occas	Dry slopes	R					x	x
Thermospis montana Nutt.	Occas	Streamside	L			x	x		
Trifolium monanthum Gray	Occas	Moist sites	R					x	x
T. pratense L.	Occas	Damp sites	R			x	x		
T. variegatum Nutt.	LAbund	Meadow	L			x			
Vicia americana Muhl.	Freq	Sage-grass community	L			x	x		
GERANIACEAE - Geranium F.									
Geranium richarsonii Fisch. & Trautv.	Freq	Aspen community	L				x		
G. viscosissimum Fisch. & Meyer	Freq	Aspen & sage-grass comm.	L			x	x		

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SPECIES LIST

Ruby and East Humboldt Mountains

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LINACEAE - Flax F.									
Linum lewisii Pursh	Occas	Sagebrush community	R			x			
ACERACEAE - Maple F.									
Acer glabrum Torr.	Occas	Brush type	L			x			
RHAMNACEAE - Buckthorn F.									
Ceanothus velutinus Dougl. var. velutinus	L.Abund	Brush type	L			x			
MALVACEAE - Mallow F.									
Sidalcea neomexicana Gray	Occas	Moist soils	L	x					
Sphaeralcea munroana (Dougl.) Spach ssp. munroana	Occas	Dry slopes	R	x	x				
HYPERICACEAE - St.John's Wort F.									
Hypericum anagalloides Cham. & Schlecht.	Local	Damp sandbank (stream)	R			x			
H. formosum HBK ssp. scouleri (Hook.) C. L. Hitchc.	Occas	Damp sites	L			x	x		
VIOLACEAE - Violet F.									
Viola adunca J. E. Smith var. adunca	Occas	Meadows	L			x	x		
V. adunca J. E. Smith var. bellidifolia (Greene)Harrington	Occas	Moist areas	L					x	x
V. macloskeyi Lloyd var. pallens (Banks) C. L. Hitchc.	Rare	Wet Sites	R				x	x	
V. nuttallii Pursh var. major Hook.	Occas	Grass-forb community	R				x	x	
LOASACEAE - Blazing Star F.									
Mentzelia albicaulis Dougl.	Occas	Sage-grass community	L			x			
CACTACEAE - Cactus F.									
Opuntia polycantha How.	Occas	Dry slopes	R		x				
ELEAGNACEAE - Oleaster F.									
Shepherdia canadensis (L.) Nutt.	Occas	Aspen community	L			x	x		

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Ruby and East Humboldt Mountains

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ONAGRACEAE - Evening Primrose F.									
Circaea alpina var. pacifica (Asch. & Magnus) M. E. Jones	Occas	Shady sites	R					x	
Epilobium adenocaulon Hausskn.	Occas	Boggy soils	R		x				
E. alpinum L. var. clavatum (Trel.) C. L. Hitchc.	Freq	Boulder slopes	R					x	x
E. alpinum L. var. lactiflorum (Hausskn.) C. L. Hitchc.	Occas	Open areas, brush type	R			x	x		
E. angustifolium L.	Freq	Timber openings	L				x	x	
E. latifolium L.	Occas	Forest openings	L					x	
E. minutum Lindl.	Occas	Mahogany community	L			x			
E. obcordatum Gray	Occas	Rocky slopes	L					x	x
E. palustre L.	Occas	Boggy sites	R	x					
E. paniculatum Nutt.	Freq	Dry slopes	L			x			
Gayophytum nuttallii Torr.& Gray	Freq	Brush type, warm, dry	L			x			
G. racemosum Torr. & Gray	Occas	Dry slopes	L			x			
Oenothera caespitosa Nutt. var. purpurea (S. Wats.) Munz	Occas	Dry slopes	L			x	x		
OE. hookeri Torr. & Gray var. angustifolia Gates	Occas	Roadbank	L			x			
UMBELLIFERAE - Parsley F.									
Angelica arguta Nutt.	Occas	Shady sites	L				x	x	
A. kingii Coult. & Rose	Freq	Streambanks	L				x	x	
Conium maculatum L.	Freq	Roadside, lower canyon	L			x			
Cymopterus humboldtensis M.E.Jones	Occas	Damp ledges	L				x	x	
C. nivalis S. Wats.	Occas	Slopes (endemic)	R					x	
Ligusticum grayi Coult. & Rose	Freq	Damp, open woods	L				x	x	
Lomatium dissectum (Nutt.) Math. & Const. var. eatonii (Coult. & Rose) Cronq.	Occas	Open slope and flats	R			x	x	x	
L. nevadensis S. Wats.	Occas	Dry slopes	R	x	x				
L. nuttallii (Gray) Macbr. var. alpinum (S. Wats.) Mathias	Occas	Dry slopes	R					x	
Osmorhiza depauperata Phil.	Occas	Cool, damp shade	L			x			
Perideridia bolanderi (Gray) Nels. & Macbr.	Occas	Sage-grass community	L			x			
P. gairdneri (Hook. & Arn)Mathias	Occas	Forb community	L					x	
Pteryxia hendersonii (Coult. & Rose) Cronq.	Occas	Dry slope	R					x	
P. petraea (Jones) Mathias	Freq	Dry, rocky slopes	R					x	
CORNACEAE - Dogwood F.									
Cornus stolonifera Michx. var. occidentalis(Torr.&Gray)C.L.Hitchc	Freq	Streamside	L			x			

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SPECIES LIST

Ruby and East Humboldt Mountains

Species	Frequency	Habitat Site	Location	Zones: Valley	P-J	Mt. Brush	Aspen	Subal.-Con.	Alpine
PYROLACEAE - Wintergreen F.									
Pterospora andromedia Nutt.	Occas	Moist woods	R					x	
Pyrola asarifolia Michx. var. incarnata (Fisch.) Fern.	Freq	Moist shade	R					x	
P. secunda L.	Occas	Shady areas	R					x	
ERICACEAE - Heath F.									
Arctostaphylos uva-ursi (L.)Spreng.	Occas	Moist ledges	R					x	
Kalmia polifolia Wang. var. microphylla (Hook.) Rehd.	Occas	Boggy areas	R					x	x
Ledum glandulosum Nutt.	Occas	Open timber	L					x	
Vaccinium caespitosum Michx.	Occas	Moist woods	R					x	
V. occidentale Gray	Common	Open woods	L					x	
PRIMULACEAE - Primrose F.									
Androsace septentrionalis L. var. puberulenta (Rydb.) Knuth.	Occas	Moist sites	R					x	
Dodecatheon alpinum (Gray) Greene	Freq	Meadows & parks	L					x	
D. jeffreyi Van Houtte	Freq	Wet sites	L			x	x		
D. pulchellum (Raf.) Merrill var. pulchellum	Local	Meadows & seeps	L			x	x		
Primula parryi A. Gray	LAbund	Streamside	L					x	
GENTIANACEAE - Gentian F.									
Frasera speciosa Dougl.	Occas	Open slopes	L				x		
Gentiana calycosa Griseb. var. asepala (Maguire) C.L. Hitchc.	Freq	Boggs & meadows	L					x	
G. monantha A. Nels.	Occas	Meadow	R					x	
G. parryi Engelm.	Occas	Meadows	R					x	
G. tenella Rottb.	Occas	Moist sites (Lamoille L.)	L					x	
Swertia perennis L.	Freq	Wet sites	L					x	
APOCYNACEAE - Dogbane F.									
Apocynum androsaemifolium L.	Occas	Roadbanks	L			x			
CONVOLVULACEAE - Morning Glory F.									
Convolvulus arvensis L.	Occas	Roadside	L			x			
CUSCUTACEAE - Dodder F.									
Cuscuta californica Choisy var. apiculata Engelm.	Occas	On Eriogonum	R			x			

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Ruby and East Humboldt Mountains

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POLEMONIACEAE - Phlox F.									
Collomia grandiflora Dougl.	Occas	Dry slopes	R		x				
C. linearis Nutt.	Freq	Aspen understory	L		x	x			
Gilia aggregata (Pursh) Spreng.	Occas	Sage-grass community	L			x			
G. congesta Hook. var. montanum (A.Nels.& Kennedy)Const.& Roll.	Rare	Dry ridges	R						x
G. congesta Hook. var. palmifrons (Brand) Cronq.	Occas	Dry slopes	R		x				
G. sinuata Dougl. var. sinuata	Occas	Dry slopes	R			x			
G. tenerrima Gray	Freq	Cercocarpus community	L			x			
Leptodactylon pungens (Terr.)Nutt.	Occas	Dry sagebrush community	L			x	x		
Linanthus harknessii(Curran)Greene	Occas	Sage-grass community	L			x			
Linanthastrum nuttallii(Gray)Ewan	Freq	Dry open woods	L				x		
Phlox hoodii Rich.	Freq	Dry foothills	R		x				
P. longifolia Nutt.	Occas	Sage-grass community	L			x			
P. pulvinata (Wherry) Cronq.	Freq	High slopes	R					x	x
P. stansburyi (Torr.) Heller	Occas	Low-growth sagebrush	L				x	x	
Polemonium pulcherrimum Hook.	Occas	Forb-grass community	R				x		
P. occidentale Greene	Occas	Wet sites (Lamoille)	L	x					
P. viscosum Nutt. ssp. viscosum	Occas	Among rocks	R						x
HYDROPHYLLACEAE - Waterleaf F.									
Hesperochiron californicus(Benth.) S. Wats.	Occas	Moist meadows	R	x	x	x			
Hydrophyllum capitatum Dougl. var. alpinum S. Wats.	Freq	Moist shade	R			x	x		
Nemophila breviflora Gray	Freq	Cool damp shade	L			x	x		
Phacelia gymnoclada Torr.	Occas	Sage-grass community	R			x			
P. hastata Dougl. var. alpina (Rydb.) Cronq.	Occas	Sage-grass community	L			x	x		
P. hastata Dougl. var. compacta (Brand) Cronq.	Freq	Open areas, brush type	L			x	x		
P. heterophylla Pursh	Occas	Dry slopes	R			x			
P. idahoensis Henderson	Occas	Meadows & slopes	R			x			
P. sericea (Grah.) var. ciliosa Rydb.	Occas	Open woodland	L			x	x		
BORAGINACEAE - Borage F.									
Cryptantha affinis (Gray) Greene	Freq	Open slopes	L			x			
C. torreyana (Gray) Greene	Freq	Sage-grass community	L			x			
C. watsonii (Gray) Greene	Freq	Sage-grass community	R	x		x			
Hackelia floribunda(Lehm.)Johnst.	Freq	Aspen openings	L				x		
H. jessicae (McGregor)	Freq	Cercocarpus (damp-cool)	L			x			
H. patens (Nutt.) I. M. Johnst.	Freq	Sage-grass community	L			x			

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SPECIES LIST

Ruby and East Humboldt Mountains

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Lappula echinata Gilib.	Freq	Disturbed areas	R		x	x			
L. redowski (Hornem.) Greene	Occas	Sage-grass community	L			x			
Lithospermum ruderale Dougl.	Freq	Sage-grass community	L			x			
Mertensia arizonica Greene var. leonardi (Rydb.) I.M. Johnst.	Occas	Aspen & forb-grass comm.	R				x		
M. ciliata (James) G. Don	Freq	Brookside	L					x	
M. oblongifolia (Nutt.)G.Don var. nevadensis(S.Nels.)L.O.Williams	Freq	Sage-grass community	L			x			
VERBENACEAE - Verbena F.									
Verbena bracteata Lag. & Rodr.	Occas	Sage-grass community	L			x			
LABIATAE - Mint F.									
Agastache urticifolia(Benth.)Kunz	Freq	Aspen community	L				x		
Marrubium vulgare L.	Occas	Waste areas	L			x			
Monardella odoratissima Benth. var. glauca (Greene) St.John	Freq	Open slopes &brush type	L			x	x		
Prunella vulgaris L.	Local	Moist site (Ruby Mts.)	R			x			
Scutellaria antirrhinoides Benth.	Freq	Sage-grass community	L			x			
SOLANACEAE - Potato F.									
Nicotiana attenuata Torr.	Occas	Roadsides	R	x	x				
SCROPHULARIACEAE - Figwort F.									
Castilleja chromosa A. Nels.	Freq	Sage-grass community	L		x	x			
C. lapidicola Heller	Rare	Open timber & high slopes	R					x	x
C. linariaefolia Benth.	Freq	Sage-grass community	L			x			
C. linoides Gray	Occas	Open slopes (endemic)	R			x			
C. magnistylis Edwin	Occas	Open slopes (endemic)	R			x			
C. miniata Dougl.	Freq	Aspen & brush community	L			x	x	x	
C. pilosa (S. Wats.) Rydb.	Occas	Sage-grass community	R			x			
C. rubida Piper	Rare	Open alpine slopes	R						x
C. viscidula Gray	Freq	Open slopes	L					x	
Collinsia parviflora Dougl.	Freq	Sage-grass community	L			x	x		
Mimulus breweri (Greene) Cov.	Occas	Sage-grass community	L			x	x		
M. guttatus DC. var. guttatus	L.Abund	Streamside	L			x			
M. guttatus DC. var. depauperatus (Gray) Greene	L.Abund	Streamside	L			x			
M. parryi Gray	L.Abund	Wet meadows	L				x	x	
M. primuloides Benth.	L.Abund	Wet meadows	L				x	x	
M. rubellus Gray	Occas	Wet sites	L					x	
M. suksdorfii Gray	Freq	Damp site (CELE type)	L			x			
M. tilingii Regel	L.Abund	Streamside	L			x	x	x	

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SPECIES LIST

Ruby and East Humboldt Mountains

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Pedicularis groenlandica Retz.	Occas	Wet meadows	L				x	x	
Penstemon deustus Dougl.	Occas	Sage-grass community	L			x			
P. humilis Nutt. var. humilis	Freq	Dry slopes	R			x	x	x	
P. humilis Nutt. var. brevifolius (Gray) Keck	Freq	Rocky slopes	R					x	x
P. kingii S. Wats.	Occas	Dry slopes	R			x			
P. pratensis Greene	Common	Sage-grass community	L				x	x	
P. procerus Dougl. ssp. modestus (Greene) Keck	Occas	Dry slopes (endemic)	R			x	x		
P. radicosus A. Nels.	Freq	Dry slopes	R			x	x		
P. rydbergii A. Nels.var.rydbergii	Occas	Damp sites	R				x	x	
P. speciosus Dougl.	Freq	Sage-grass community	L			x			
P. watsonii Gray	Common	Sage-grass & mahogany	L			x	x		
Verbascum thapsus L.	Occas	Roadsides	R			x			
Veronica americana Schw.	Freq	Streamside	L			x	x		
V. wormskjoldii Roem. & Schult.	Freq	Meadows	L					x	x
OROBRANCHACEAE - Broomrape F.									
Orobranche californica Cham. & Schlecht. var. corymbosa (Rydb.) Munz	Occas	Sagebrush community	R			x			
O. uniflora L. var. minute (Suksd.) Beck	Rare	Moist slopes	L			x			
PLANTAGINACEAE - Plaintain F.									
Plantago lanceolata L.	Occas	Dry dooryard	L				x		
RUBIACEAE - Madder F.									
Galium aparine L.	Freq	Moist shade	L			x	x		
G. bifolium S. Wats.	Occas	Aspen type	R				x		
G. multiflorum Kellogg	Freq	Open slopes	R			x	x		
Kelloggia galioides Torr.	Occas	Sage-grass community	L			x			
CAPRIFOLIACEAE - Honeysuckle F.									
Lonicera involucrata (Rich.)Banks	Freq	Riparian community	L			x	x		
Sambucus caerulea Raf.	Freq	Sage-grass community	L			x	x		
Symphoricarpos oreophilus Gray var. utahensis(Rydb.) A.Nels.	Common	Mahogany & aspen community	L			x	x		
VALERIANACEAE - Valerian F.									
Valeriana californica Heller	Occas	Forb-grass	R					x	
V. edulis Nutt.	Occas	Moist slopes	R				x		
V. occidentalis Heller	Freq	Damp shade	L			x	x	x	

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Ruby and East Humboldt Mountains

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COMPOSITAE - Sunflower F.									
Achillea millefolium L. ssp. lanulosa (Nutt.) Piper	Freq	Aspen & forb-grass comm.	L			x	x	x	
Agoseris aurantica (Hook.) Greene var. aurantica	Occas	Damp meadows & slopes	L			x	x		
A. glauca (Pursh) Raf. var. laciniata (D.C. Eat.) Smiley	Freq	Mesic sites, open woods	L					x	
Anaphalis margaritaceae (L.)Benth	Rare	Brush type	R			x			
Antennaria rosea Greene	Freq	Dry slopes & ridges	L			x			
A. umbrinella Rydb.	Freq	Open slopes	L					x	x
Arnica amplexicaulis Nutt.	Freq	Streamsides	R				x	x	
A. chamissonis Less. ssp. foliosa (Nutt.) Maguire	Freq	Damp meadow edge	R					x	
A. cordifolia Hook.	Occas	Conifer understory	R					x	
A. longifolia D.C. Eat.	Occas	Rocky sites, streamsides	R					x	
A. mollis Hook.	Common	Damp sites	L					x	
Artemisia arbuscula Nutt. var. arbuscula	L.Abund	Dry hills and benches	R		x	x			
A. arbuscula Nutt. var. nova (A. Nels.) Cronq.	L.Abund	Dry hillsides	R	x	x				
A. frigida Willd.	Occas	Dry slopes	R			x			
A. ludoviciana Nutt. ssp. ludoviciana	Freq	Canyon bottoms	L			x	x		
A. michauxiana Bess.	Freq	Woodlands	L				x	x	
A. tridentata Nutt. ssp. tridentata	Abund	Dry slopes	R	x					
A. tridentata Nutt. ssp. vaseyana (Rydb.) Beetle	Abund	Open slopes	L					x	x
Aster alpigenus (Torr.&Gray) Gray var. haydenii (Porter) Cronq.	Freq	Open slopes	L					x	x
A. chilensis Nees ssp. adscendens (Lindl.) Cronq.	Occas	Aspen community	L				x		
A. engelmannii (D.C.Eat.) Gray	Occas	Aspen community	R				x		
A. foliaceus Lindl. var. parryi (D.C.Eat.) Gray	Occas	Aspen community	L				x		
A. occidentalis (Nutt.) Torr. & Gray var. occidentalis	Freq	Streamside meadows	L					x	
A. perelegans A. Nels. & Macbr.	Occas	Aspen community	L				x		
Balsamorhiza sagittata (Pursh)Nutt.	Freq	Sage-grass community	L			x			
Brickellia microphylla (Nutt.)Gray	Rare	Dry slopes	R			x			
Chaenactis douglasii(Hook.)Hook.& Arn. var. achilleafolia (Hook. & Arn.) A. Nels.	Occas	Sage-grass community	L			x			
Chrysopsis villosa (Pursh) Nutt. var. hispida (Hook.) Gray	Freq	Dry roadside	L			x			

L = Lamoille Canyon
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SPECIES LIST

Ruby and East Humboldt Mountains

Species	Frequency	Habitat Site	Location	Zones: Valley	P-J	Mt. Brush	Aspen	Subal.-Con.	Alpine
Chrysothamnus nauseosus(Pall.)Britton var.albicaulis(Nutt.) Rydb.	Freq	Dry roadside	L			x			
C. viscidiflorus (Hook.) Nutt. var. elegans (Greene) Blake	Freq	Dry roadside	L			x			
C. viscidiflorus (Hook.) Nutt. var. lanceolatus (Nutt.) Greene	Freq	Sage-grass community	L			x	x		
Cirsium eatoni (Gray) Robins	Freq	Dry slopes	L					x	
C. foliosum (Hook.) DC.	Freq	Forb-grass community	L				x	x	
C. utahensis Petrak.	Freq	Sage-grass community	R			x			
Crepis acuminata Nutt.	Freq	Sage-grass community	L			x			
C. atrabarba Heller	Freq	Sage-grass community	L			x			
Erigeron argentatus Gray	Occas	Dry slopes	R		x	x			
E. asperugineus (D.C.Eat.) Gray	Occas	Dry slopes	L				x	x	
E. bloomeri Gray	Occas	Sage-grass community	L		x	x			
E. caespitosus Nutt.	Occas	Forb-grass community	L				x	x	
E. callianthemus Greene	Freq	Forb-grass community	L				x	x	
E. leiomerus Gray	Occas	Open timber, high slopes	R					x	
E. pumilus Nutt. ssp. concinnoides Cronq.	Freq	Sage-grass community	L			x			
E. tener (Gray) Gray	Freq	Mahogany community	L			x			
E. watsoni (Gray) Cronq.	Occas	Rocky cliffs	L					x	
Eriophyllum lanatum (Pursh)Forbes var. integrifolium(Hook.)Smiley	Freq	Open slopes	L				x	x	
Eupatorium occidentale Hook.	Local	Ledges	L				x		
Grindelia squarrosa (Pursh) Dunal	Freq	Dry roadside	L			x			
Gutierrezia sarothrae (Pursh) Britt. & Rusby	Occas	Dry slopes	L			x			
Haplopappus acaulis (Nutt.) Gray	Freq	Dry slopes & ridges	L			x		x	
H. macronema Gray	Freq	Open slopes	L					x	x
H. suffruticosus (Nutt.) Gray	Freq	Rocky ridges	L			x		x	
H. watsoni Gray	Freq	Dry rocky slopes	R			x	x		
Helenium hoopesii Gray	Freq	Open timber	L				x	x	
Helianthella uniflora (Nutt.) Torr. & Gray	Freq	Open slopes	L			x	x	x	
Machaeranthera canescens (Pursh) Gray	Occas	Dry slopes	L			x	x		
M. leucanthemifolia(Greene)Greene	Occas	Warm dry slopes	L			x			
Microseris troximoides Gray	Freq	Sage-grass community	L			x			
Rudbeckia occidentalis Nutt.	Freq	Aspen community	L				x		
Senecio amplectans Gray var. holmii (Greene) Harrington	Occas	Open meadows	L					x	
S. canus Hook.	Occas	Rocky slopes	R					x	x
S. crassulus Gray	Freq	Aspen & mahogany comm.	L			x	x		
S. cymbalarioides Boek.	Occas	Open slopes	L					x	
S. integerrimus Nutt. var. exaltatus (Nutt.) Cronq.	Freq	Sage-grass community	L			x			

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Senecio dimorphophyllus Greene var. paysoni J. M. Barkley	Occas	Aspen community	L				x		
S. multilobatus Torr. & Gray	Freq	Open slopes	L			x	x	x	
S. pseudaureus Rydb.	Occas	Streamside	L			x			
S. serra Hook.	Occas	Aspen community	L				x		
S. streptanthifolius Greene	Occas	Mahogany community	L			x			
S. triangularis Hook.	Freq	Wet sites	R				x	x	
Solidago canadensis L. var. salebrosa (Piper) M. E. Jones	Occas	Riparian community	R			x	x		
S. missouriensis Nutt. var. missouriensis	Occas	Moist woods	R				x	x	
S. multiradiata Ait.	Occas	Damp meadows	R					x	
S. spathulata DC.	Occas	Grass-forb	R					x	
Taraxacum officinale Weber	Freq	Open areas	L			x	x	x	
Tragopogan dubius Scop.	Occas	Sage-grass community	L			x			
Tetradymia canescens DC.	Occas	Sage-grass	R			x			
Wyethia amplexicaulis Nutt.	LAbund	Foothills, heavy soils	R			x			

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